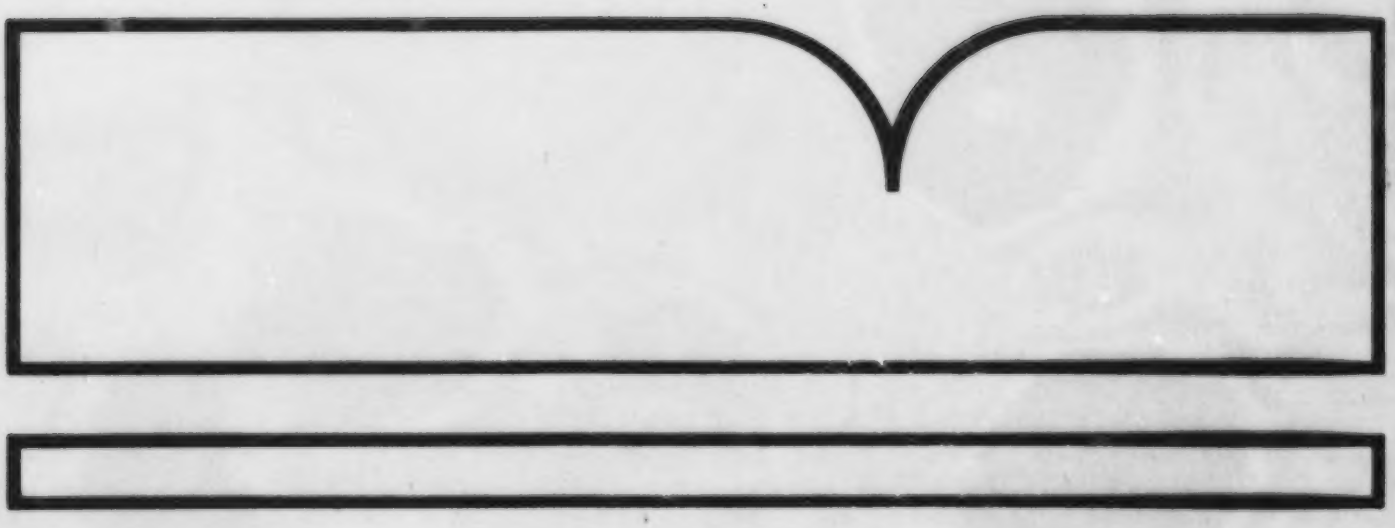
PB85-232114

Superfund Record of Decision (EPA Region 3) McAdoo Associates, Schuylkill County Pennsylvania, June 1985

(U.S.) Environmental Protection Agency
Washington, DC

28 Jun 85



U.S. Department of Commerce
National Technical Information Service
NTIS

United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R03-85/012
June 1985

PB85-232114

EPA

Superfund Record of Decision:

McAdoo Associates, PA

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TECHNICAL REPORT DATA
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1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA/ROD/R03-85/012		PB85 232114/AS

4. TITLE AND SUBTITLE	5. REPORT DATE
SUPERFUND RECORD OF DECISION McAdoo Associates, PA	June 28, 1985 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Same as box 12.	10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS U.S. Environmental Protection Agency 401 M Street, S.W. Washington, D.C. 20460	13. TYPE OF REPORT AND PERIOD COVERED Final ROD Report 14. SPONSORING AGENCY CODE 800/00

15. SUPPLEMENTARY NOTES

DOCUMENT COMPLETE AS PAGINATED BY SOURCE.

16. ABSTRACT

The McAdoo Associates site is an eight acre track of land located in Schuylkill County in northeastern Pennsylvania. It is situated approximately 1½ miles south of McAdoo Borough on U.S. Route 309. The site and adjacent area was once used extensively for deep and strip mining of anthracite coal. Mining activities started in 1884 and continued periodically until 1962. After the site was acquired by McAdoo Associates in January 1975, two rotary-kiln furnaces and a vertical liquid waste incinerator were installed and operated as part of a metals reclaiming operation. A log maintained by McAdoo Associates shows acceptance of a variety of wastes from January 1977 through November 1978. These wastes include: paint sludges, spent solvents, metallic sludges, acid and caustic liquids, toluene, waste oil/water, solid wastes and other miscellaneous residuals. None of the incoming waste streams received prior to January 1977 were logged into the facility.

The selected remedial action for the McAdoo site includes: removal of the tank and debris; limited excavation of soils with off-site disposal in a RCRA facility; capping; diversion of surface water and maintenance of surface water diversion ditches and cover. In addition, a comprehensive mining study to determine appropriate cap design and an evaluation of the dilution factor will be undertaken during the design phase. The total capital cost for the selected remedial alternative is estimated to be $2,360,000.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Record of Decision McAdoo Associates, PA Contaminated Media: soil, gw, sw Key contaminants: paint sludges, spent solvents, metallic sludges, acid and caustic liquids, toluene, waste oil/water and solid wastes.		

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
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	None	

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION

SITE: McAdoo Associates Site, Schuylkill County, Pennsylvania

DOCUMENTS REVIEWED

I am basing my decision on the following documents describing the analysis of cost-effectiveness of remedial alternatives for the McAdoo Associates Site:

- McAdoo Associates Remedial Investigation
- McAdoo Associates Feasibility Study
- Summary of Remedial Alternative Selection
- Responsiveness Summary

DESCRIPTION OF SELECTED REMEDY

- Removal of the tank and debris, limited excavation of soils with off-site disposal in a RCRA facility in accordance with current EPA off-site disposal guidance, capping to meet intent of RCRA, and diversion surface water.
- A comprehensive mining study to determine appropriate cap design and an evaluation of the dilution factor will be undertaken during the design phase. If the affectiveness of the recommended remedy would change as a result of the information from the study, an amendment to this Record of Decision will be required.
- Maintenance of surface water diversion ditches and cover.

DECLARATIONS

Consistent with the Comprehensive Environmental Response Compensation, and Liability Act of 1980 (CERCLA), and the National Contingency Plan (40 CFR Part 300), I have determined that limited excavation with off-site disposal in a RCRA facility, covering in accordance with RCRA, 40 CFR 264.310(a) and Diversion of Surface Water at the McAdoo Associates Site is a cost-effective remedy and provides adequate protection of public health, welfare, and the environment. The State of Pennsylvania has been consulted and agrees with the approved remedy. They have suggested that we include applying lime to the soil in the removal/cover remedy. This will be considered in the design phase. In addition, the action will require future operation and maintenance activities to ensure the continued effectiveness of the remedy. These activities will be considered part of the approved action and eligible for Trust Fund monies for a period of 12 months.

I am deferring selection of Remedial Response Measures, if any, for the mine pool and surface water. Additional evaluation of these areas will continue.

I am delegating to the Regional Administrator the responsibility for approving ROD amendments concerning the selection of the remedy for this operable unit for the McAdoo Site.

I have also determined that the action being taken is appropriate when balanced against the availability of Trust Fund monies for use at other sites. In addition, the off-site transport and secure disposition is more cost-effective than other remedial actions, and is necessary to protect public health, welfare or the environment.

June 28, 1985
Date

Allyn M. Davis for JWM
Jack W. McGraw, Acting Assistant Administrator
Office of Solid Waste and Emergency Response

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
841 Chestnut Building
Philadelphia, Pennsylvania 19107

SUBJECT: McAdoo Site - Record of Decision

DATE: JUN 19 1985

FROM: Stanley L. Laskowski MFV
for Deputy Regional Administrator (3RA00)

TO: Jack McGraw, Acting Assistant Administrator
Office of Solid Waste and Emergency Response (WH-562-A)

I have reviewed the proposed action to be taken at the McAdoo Superfund Site and recommend that the Agency fund the recommended alternative as described in detail in the Record of Decision document. The Pennsylvania Department of Environmental Resources concurs with this recommendation.

The estimated capital cost of this Federal lead project is approximately $2,360,000.

Please call me at 597-9814 if you have any questions.

IV

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
Post Office Box 2063
Harrisburg, Pennsylvania 17120
April 29, 1985

(717) 783-7816

U.S. Environmental Protection Agency
Attn: Tom Voltaggio (3HW20)
Region III
841 Chestnut Street
Philadelphia, PA 19106

Re: McAdoo Associates - Kline Township Site
ROD Review

Dear Mr. Voltaggio:

This is to provide comments on the third revision of the Record of Decision (ROD) for the McAdoo Kline Township Site. We are pleased to inform you that DER concurs with the goals set forth by the proposed remedial actions. We feel that the current proposed removal of wastes and contaminated soils will insure the protection of public health and the environment.

On March 25, 1985, our comments concerning the third revision were provided to Mr. DiGiulio (EPA Project Officer), during a telephone conversation. This letter confirms the discussion which was as follows:

1. We recommend that after the excavation of contaminated soils and site grading, that lime be incorporated into the top twelve inches of the top soil at the site, prior to construction of the cap. Site soils should be adjusted to pH 6.5 or greater. This will reduce the mobility, availability, and toxicity of any trace metal contamination which may remain at the site.

2. Since mine subsidence is a concern which has been discussed repeatedly, we suggest that the remedial design of the cap include a provision to allow for any future mine subsidence at the site. This may make future cap maintenance much easier.

3. Soil excavation, site grading, and cap placement activities may destroy or alter the integrity of monitoring wells currently on site. We would suggest that an additional one or two monitoring wells be installed at the southeast area off the site, in the vicinity of borings #8 and #10 as part of the last phase of remedial construction. To the extent possible, existing wells should be maintained for future monitoring.

✓

Since the RI/FS has been completed for approximately nine months and these are comments on the third revision of the ROD, I am hopeful that this will conclude our review of this remedial planning effort and that an expeditious approval of the ROD will be forthcoming.

Do not hesitate to contact me if we can offer any additional assistance.

Very truly yours,

Dwight D. Worley

Dwight D. Worley, Chief
Division of Operations
Bureau of Solid Waste Management

Summary of Remedial Alternative Selection
McAdoo Associates Site

Site Location and Description

The McAdoo Associates site is an eight acre track of land located in Schuylkill County in northeastern Pennsylvania. It is situated approximately 1 1/2 miles south of McAdoo Borough on U.S. Route 309. The property is presently owned by First Valley Bank of Bethlehem, Pennsylvania and the Reading Company of Pennsylvania.

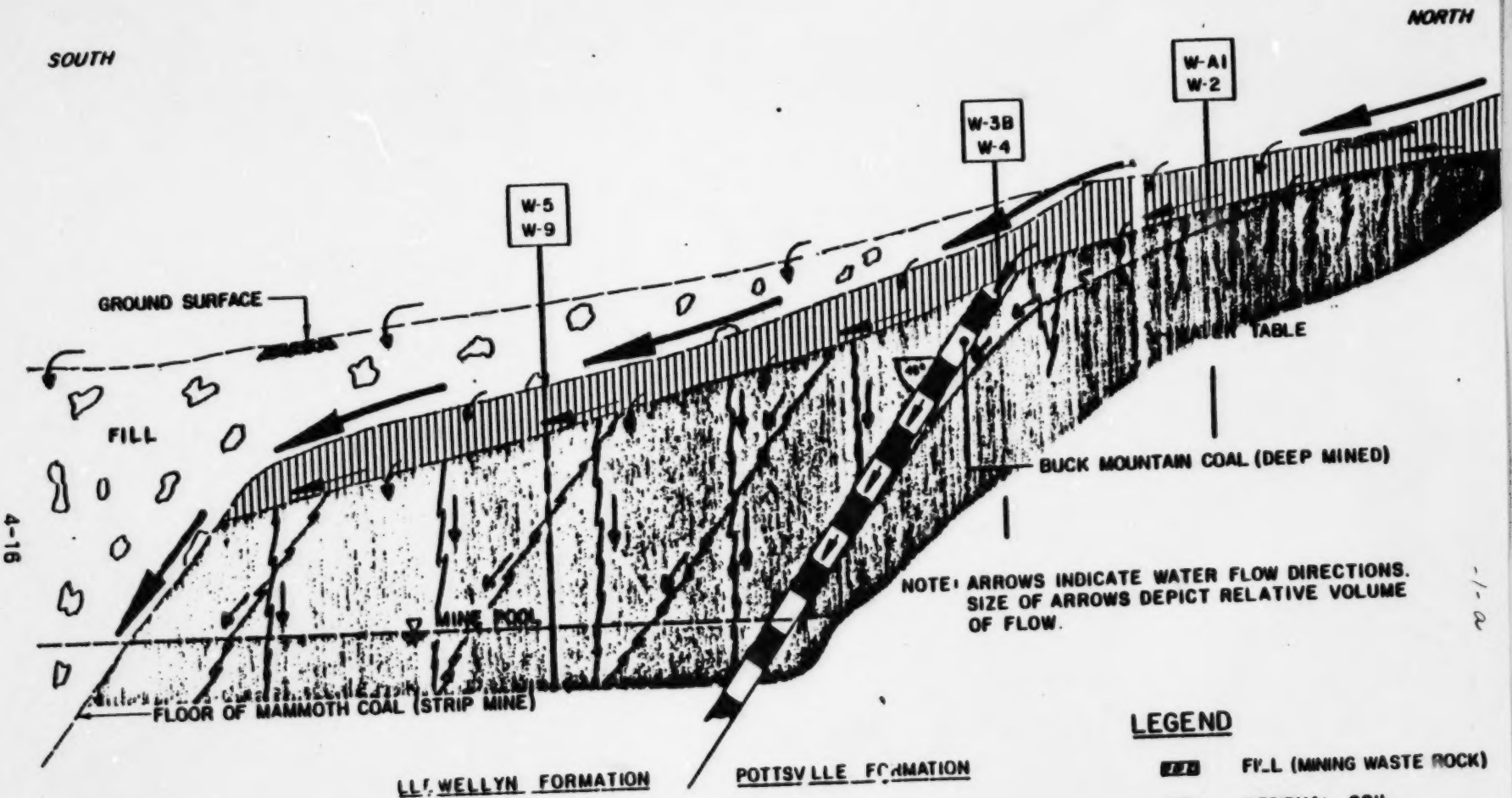
Coal refuse constitutes most of the site and surrounding area. The site and adjacent area was once used extensively for deep and strip mining of anthracite coal. Several homes are located within 1/4 mile north of the site. Population is greater than 10,000 for McAdoo and the surrounding areas. An aquifer system known as the Mauch Chunk Formation supplies drinking water for people living in the area who rely on ground water. The shallow aquifer system underlying the site consists of mined out coal seams and is collectively known as the mine pool. The mine pool drains into the Little Schuylkill River, a stream significantly affected by acid mine drainage. The site does not lie in a flood plain.

The site is presently enclosed by a chain link fence. Surface debris such as wooden pallets, concrete slabs and contaminated soils are located throughout the site. In addition, a 1-2 inch thick resin-like sheet resulting from a spill over a one acre area and a 15,000 gallon tank containing about 1300 gallons of hazardous liquid and sludge material lie in the northern portion of the site.

Site History

The area was once used extensively for deep and strip mining of anthracite coal. Mining activities started in 1884 and continued periodically until 1962. Coarse and fine rock refuse from mining constitute most of the site. After the site was acquired by McAdoo Associates in January 1975, two rotary-kiln furnaces and a vertical liquid waste incinerator were installed and operated. These units were used for reclaiming metals by burning off impurities on metal turnings and for drying high-metal content sludges. Waste solvents were reportedly used as the fuel. These incinerators were not used after 1977, due to noncompliance with Pennsylvania Department of Environmental Resources (PADER) air regulations. The operator applied to PADER for a permit to operate a new rotary kiln incinerator in Janurary 1978, but the unit failed to meet compliance requirements and was abandoned after August 1978.

The operator submitted an application for a solid waste permit to the PADER in January 1978 and was granted a conditional permit on May 18, 1978. PADER repeatedly attempted to get McAdoo Associates to implement requirements attached to the permit. After all attempts failed, the permit was revoked and the site operations subsequently closed on April 13, 1979.



WELL LOCATIONS ARE GRAPHIC ONLY TO SHOW MONITORED ZONES

IDEALIZED CROSS SECTION

FIGURE 4

GENERALIZED GROUNDWATER FLOW PATHS
McADOO ASSOCIATES SITE, KLINE TOWNSHIP, PA

NOT TO SCALE

NUS CORPORATION
A Halliburton Company

A log maintained by McAdoo Associates shows acceptance of a variety of wastes from January 1977 through November 1978. The logged wastes included: 12,560 drums of paint sludges, spent solvents, and metallic sludges including cyanide, beryllium, and sodium wastes; 394,000 gallons of bulk acidic and caustic liquids, toluene, and waste oil/water; 13,226 tons of solid wastes including grinding grit (11,821 tons), zinc wastes (60 tons), lead silicate (20 tons), refractory brick (1085 tons), and magnesium sludge (20 tons); and other miscellaneous residuals. None of the incoming waste streams received prior to January 1977 were logged into the facility.

At the time of closure of operations in July 1979, the site contained 6,790 drums of hazardous waste and several 15,000-gallon and 10,000-gallon storage tanks of hazardous waste. In 1980, PADER erected a chain-link fence. In early 1981 through 1982, the potentially responsible parties disassembled and removed the incinerator buildings, and removed the drums and all but one of the 15,000-gallon storage tanks.

Current Site Status

In May 1983, EPA sponsored a Superfund Remedial Investigation/ Feasibility Study (RI/FS) to supplement previous findings and provide sufficient data to plan cleanup strategies. The following sections highlight the site work completed.

1. Hydrogeologic Conditions

Geologic structure in the vicinity of the site is very complicated. The stratigraphy underneath and in the vicinity of the site, however, was determined during the Remedial Investigation. The site is located within a synclinal basin within 100 feet of a high angle reverse fault. Rock strata in Kline Township are tightly folded synclines and anticlines interspersed with several faults. The three uppermost formations underlying the site border of occurence are the Llewellyn, Pottsville and Mauch Chunk. The Mauch Chunk formation is composed of red shale, gray sandstone and siltstone. The red shale forms a productive aquifer used in the area and tapped by local residential wells. The Pottsville formation overlies the Mauch Chunk and is composed of resistant, well-cemented, coarse grain sandstone and conglomerates. The Llewellyn formation overlies the Pottsville formation, and is composed chiefly of sandstone and the Mammouth and Buck Mountain coal seams. The Buck Mountain seam outcrops through the northern end of the site while the Mammouth seam outcrops within 50 feet of the southeastern end of the site. The Buck Mountain seam was extensively deep-mined resulting in a labyrinth of underground, interconnected mine shafts and rock tunnels in the sandstone bedrock. These mine shafts and rock tunnels collectively form a bedrock aquifer system known as the mine pool. The ground water in the mine pool is thought to vary in elevation as much as 20 feet during the year within the Llewellyn bedrock but does not reach the residual soil or refuse at the site.

The pool is believed to have only one outlet, which is an old mine shaft entrance known as the Silverbrook discharge. The discharge is located approximately 1500 feet south of the site and produces a stream known as the Little Schuylkill River. Figure 1 illustrates the ground water flow paths to the mine pool.

As documented in the Remedial Investigation, elevated levels of metals were detected in the mine pool and site fill. In the mine pool, aluminum, chromium, barium, beryllium, colbalt, copper, iron, nickel, manganese, zinc, and arsenic were detected at 60,000, 30, 200, 12, 270, 350, 38,000, 240, 5,500, 920, and 50 ppb respectively. Selenium and cyanide were not detected. In site fill, metals such as beryllium, nickel, chromium, and zinc were detected in higher concentrations in on-site fill than what would normally be expected in from coal refuse, as evidenced by Appendices A and B. Levels of metals in on site soil fill are believed to be higher than background because they are elevated when compared to literature values, and soil areas with high levels of metals correspond to locations where drums of metallic sludges were stored. Appendix A contains a 1984 report published by Pennsylvania State University entitled Variability in the Inorganic Content of United States Coals - A Multivariate Statistical Study. Appendix B contains information obtained from the Pennsylvania State Coal Research Institute. Beryllium, nickel, chromium, and zinc were detected in on-site fill at 28, 1720, 1370, and 48,000 ppm respectively. Mean levels of these metals in anthracite coal from the Appalachin Region from Appendix A are 2.2, 42.4, 49.0, and 20.7 ppm respectively. Levels of metal should be greater in coal than coal refuse so that Appendix A represents a conservative estimate. Other inorganics such as cadmium, lead, and cyanide were found in on-site fill in higher concentrations than are normally found in soil. No data was available on the normal concentrations of cadmium and lead in coal. Cadmium typically occurs at 0.2 ppm while lead typically occurs at about 14 ppm in United States soils. Cyanide is not believed to occur naturally in coal but is a product of axaerobic coal combustion or of industrial origin. Cadmium, lead, and cyanide were detected in site fill at concentrations up to 137, 2,830, and 44 ppm, respectively.

Elevated levels of metals detected in the mine pool might be caused by a combination of acid mine drainage and migration of metals from site fill. For example, beryllium was detected at 28 and 10 ppm in test pits 24 and 14 respectively. The mean concentration in the Buck Mountain Coal seam from Appendix B is only 0.62 ppm. Also, test pits 24 and 14 correspond to locations where sludges were believed to have been stored. Test pit 24 had strong organic odors indicative of bulk disposal while test pit 14 contained the highest concentrations of nickel and cadmium detected on-site, 1720 and 137 ppm, respectively. In addition, beryllium was detected in the mine pool at 12 ppb, a level higher than normally found in ground water. The present migration of metals from the fill to the mine pool cannot be conclusively deduced though. EPA recently sampled the Big Gorilla Quarry near the site which is considered an upgradient part of the mine pool. A comparison of beryllium, cadmium, chromium, nickel, and zinc in the Big Gorilla (upgradient), mine pool (site), and Silverbrook Discharge (downgradient) yields, inconclusive results.

Metal	Big Gorilla	Mine Pool	Silverbrook Discharge
beryllium	< 10	12	< 5
cadmium	< 10 - 20	not analyzed	1.1
chromium	< 10	30	< 10
nickel	< 50 - 1230	240	89
zinc	210 - 270	920	340

All values are in ppb.

Beryllium, zinc, and possibly nickel may be leaching from the site fill and resulting in somewhat higher than normal acid mine drainage metals levels in the mine pool. The levels of metals in the mine pool, in general, underlying the site do not appear significantly higher than levels of metals detected in the mine quarry. Further sampling would be required to substantiate any present releases of metals to the mine pool.

Metals could migrate from site fill, though, in significant concentrations if site fill came into contact with mine pool water as in the case of an incident of mine subsidence of sufficient magnitude. The pH of the mine pool water from the Big Gorilla Quarry is 3.5. At this low pH, metals freely leach from soils. PaDER has reported that mine subsidence has occured in the area. The risk and magnitude of mine subsidence is unknown at the McAdoo site. In the absence of significant mine subsidence, it is difficult to predict the mobility of metals in site fill. If metals are not presently migrating to the mine pool, they could slowly move downward in the unsaturated soil column from rainfall solubilization and migrate to the mine pool sometime in the future.

Mobility of organics present in site fill is a little easier to predict. Most nonionic hydrophobic (preferring organic phase to water phase) organics remain adsorbed to soils regardless of pH levels so the effect of mine subsidence would not be as severe as with metals. However, soils containing organic compounds under saturated conditions would be expected to leach organics at greater rates than under unsaturated soil conditions currently present on-site. If significant subsidence occured, soils containing organic compounds would come into contact with mine pool water and leaching of organics would mostly depend on the adsorption partition coefficients (Koc) of individual compounds. Adsorption partition coefficents can be thought of as the ratio of the amount of chemical adsorbed per unit weight of organic carbon in the soil or sediment to the concentration of the chemical dissolved in solution at equilbrium. Koc values may range from 1 to 10,000,000. When laboratory observed Koc values are not available, they can be calculated from linear regression equations using octanol-water coefficients (Kow). Kow is defined as the ratio of a chemical's concentration in the octanol phase to its concentration in the aqueous phase. It is an indication of a chemical's hydrophobicity. Equations using Kow values are preferable to equations utilizing other physical properties such as water solubility because of higher correlation coefficients (r2). Two equations were used to calculate Koc from

which an average value was obtained. Equation 1 was derived from Brown et. al. [log Koc = 0.937 log Kow - 0.006], has a r2 value of 0.95 and was derived from aromatics, polynuclear aromatics, triazines, and dinitroaniline herbicides. Equation 2 was derived from Karichkoff [log Koc = log kow - 0.21], has a correlation value of 1.00 and was derived using mostly aromatic or polynuclear aromatics. These equations were used because they were derived from the type of compounds present on-site. The following is a list of organic compounds detected and their calculated Koc values. The Koc values are presented to give an idea of the mobility of each contaminant detected in site soils and will be used later on to develop safe soil levels for each contaminant. All Kow values were obtained from "Water-Related Environmental Fate of 129 Priority Pollutants. Volumes I and II"- EPA 440/4-79-029 a and b.

Compound	log Kow	log Koc eqn. 1	log Koc eqn. 2	Avg. log Koc
Acids				
phenol	1.46	1.36	1.26	1.32
4-methylphenol	1.94	1.81	1.73	1.78
Base/Neutrals				
bis(2-ethylhexyl)phthalate	5.30*	4.96	5.09	5.03
butyl benzyl phthalate	5.80	5.43	5.59	5.52
di-n-butyl phthalate	5.20	4.87	5.00	4.93
diethyl phthalate	3.22	3.01	3.00	3.01
benzyl alcohol	1.50	1.40	1.29	1.34
isophorone	1.70	1.59	1.49	1.54
flouranthene	5.53	5.18	5.32	5.26
naphthalene	3.36	3.14	3.15	3.15
phenanthrene	4.46	4.18	4.25	4.22
chrysene	5.60	5.24	5.39	5.32
pyrene	5.30	4.96	5.09	5.03
benzo(a)anthracene	5.60	5.24	5.39	5.32
benzo(k)flouranthene	6.85	6.41	6.64	6.54
benzo(b)flouranthene	6.60	6.18	6.39	6.30
dibenzofuran	4.12	3.85	3.91	3.88
Volatiles				
hexachloroethane	3.34	3.13	3.13	3.13
PCBs				
PCB-1248	6.11	5.72	5.90	5.82
PCB-1254	6.03	5.64	5.82	5.74

* Two values were given (8.73 & 5.3); the lower one was chosen.

During the RI/FS study there was considerable concern about the possibility of residential well contamination near the site. Residential wells on Silverbrook Road (1/4 mile north of the site) were sampled during the RI. Silver was detected at 86 ppb in one well. The Ambient EPA Water Quality Criteria for silver is 50.0 ppb. The well was resampled several months later and did not show silver levels exceeding 50.0 ppb. The RI concluded though that water entering the residential wells does not originate from the McAdoo Associates site because the upper fractured zone of the formation is sloping downward to the south and west, and the cones of depression created by these wells are insufficient to reverse the direction of ground water flow.

Another concern was the possibility of residential well contamination of of wells located adjacent to the Little Schuylkill River from ground water recharge. This contamination also is very unlikely because the wells in question are topograhically upgradient of the river and are likely hydrologically upgradient. Under normal hydrological conditions the shallow flow would discharge into the river while deeper flow would continue beneath the river. Even under maximum pumping capacities, domestic wells do not produce enough for the cone of depression to intersect the river itself. Also, the Still Creek Reservoir is located in the same general area. Not only is the reservoir upgradient, it would also be an additional hydraulic load on the system. This effect would create higher gradients in the reservoir area causing flow patateras to be generated in the direction of the river.

2. Surface Water Conditions

As previously stated, the mine pool flows to an outfall called the Silverbrook Discharge and becomes the headwater for the Little Schuylkill River, a stream significantly affected by acid mine drainage. As one proceeds north of Tamaqua (a town approximately 12 stream miles south of the mine discharge point) towards the site, the stream becomes increasing acidic and incapable of supporting a healthy community of aquatic life. The Wilkes-Barre Regional Office of the Pennsylvania Department of Environmental Resources (PADER) recently completed an extensive inorganic analysis and a qualitative aquatic macroinvertebrate survey. The regional office sampled many points and tributaries along the Little Schuylkill River extending from the mine outfall to an area several miles south of Tamaqua from October 1 to October 15, 1984. Relevent data are presented on the next page for sampling points located in the river from the outfall to the PADER Water Quality Station 1-19 located in Walker Township (approximately four stream miles south of Tamaqua).

Data from pages 7 and 8 indicates that the stream begins to recover at LSR4 and probably could support some forms of aquatic life at LSR5. The Wilkes Barre office is presently interpreting these results.

Parameter	Location						
	LSR1	LSR2	LSR3	LSR4	LSR5	LSR6	LSR7
Flow(MGD)	0.07	2.26	3.04	7.69	9.76	27.14	29.08
pH	3.3	3.6	3.8	4.8	5.7	7.1	6.8
alkalinity(mg/l)	0	0	0	2	3	28	24
acidity(mg/l)	176	128	102	60	26	0	0
hardness(mg/l)	204	93	62	45	32	678	468
sulfate(mg/l)	276	120	76	41	29	738	516
aluminum	11,000	6,000	4,800	2,200	600	900	1000
arsenic	7.3	< 4	< 4	< 4	< 4	< 4	< 4
beryllium	< 10	< 10	< 10	< 10	< 10	< 10	< 10
cadmium	2.80	0.77	2.98	0.56	0.20	0.21	< 0.2
chromium	< 70	< 70	< 70	< 70	< 70	< 70	< 70
copper	< 80	< 80	< 80	< 80	< 80	< 80	< 80
iron	8,470	7,040	1,110	520	160	1,280	990
lead	16.6	4.1	6.8	< 4	< 4	< 4	< 4
manganese	2,480	1,450	830	510	260	1,210	1,000
mercury	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
nickel	150	< 140	< 140	< 140	< 140	< 140	< 140
selenium	< 6	< 6	< 6	< 6	< 6	< 6	< 6
thallium	< 120	< 120	< 120	< 120	< 120	< 120	< 120
zinc	390	280	160	90	70	70	80

Sampling Location Description

LSR1: Little Schuylkill River, 10 yards upstream of Silverbrook Outfall

LSR2: Little Schuylkill River, 50 yards upstream of mouth of Lofty Creek (approximately 3/4 miles downstream of outfall)

LSR3: Little Schuylkill River at bridge in Village in Ginter (approximately 1 1/2 miles downstream of outfall)

LSR4: Little Schuylkill River at bridge on route 54 (approximately 7 miles downstream of outfall)

LSR5: Little Schuylkill River at first highway downstream of Locust Creek (approximately 10 miles downstream of outfall)

LSR6: Little Schuylkill River at route 309 bridge in Tamaqua (approximately 12 miles downstream of outfall)

LSR7: Little Schuylkill River at PADER monitoring station in Walker Township (approximately 17 miles downstream of outfall)

Water quality values are in parts per billion (ppb) unless otherwise noted. MGD refers to millions of gallons per day, and ppm refers to parts per million. All metals are expressed as total concentrations (dissolved and suspended).

	location						
	LSR1	LSR2	LSR3	LSR4	LSR5	LSR6	LSR7
Species							
Nematoda (roundworms)							
Oligochaeta (segmented worms)							
Astacidae (crayfish)							
Ephemeroptera (mayflies)							
Baetis spl							
B. sp2							
Pseudocloeon							
Ephemerella							
Paraleptophlebia							
Isonychia							
Stenonema							
Stenocron							
Plecoptera (stoneflies)					x		
Allonarcys proteus							
Peltoperla							
Nemoura							
Isoperla							
Acroneuria carolinensis							
A. abnomis							
A. evoluta							
A. unk. sp							
Phasganophora capitata							
Eccoptura xanthenes							
Paragnetina immarginata							
Coleoptera (beetles)							
Elmidae							
Psepheus							
Tricoptera (caddisflies)							
Hydropsyche spl							
H. sp2							
Cheumatopsyche							
Diplectrona							
Dolophilodes							
Polycentropus							
Glossosoma							
Rhyacophila					x		
Megaloptera (hellgrammites, etc.)							
Nigronia							
Corydalus							
Diptera (true flies)							
Chironomidae							
Hexatoma							
Tipula							
Atherix							
Odonata (dragonflies)							
Gomphus							
Lanthus							
Boyeria							
Macromia							
Calopteryx							
Sphaerium (clams)							
Physa (snail)							
Total Taxa	0	0	0	0	2	0	0

(X) means that the toxic is present

In two previous studies, DER had concluded that the Little Schuylkill River was degraded from acid mine drainage.

Also, in January of 1979, the Reading office concluded that the main stem (from outfall of Tamaqua) does not support a healthy aquatic community and could not support a sport fishery.

EPA Region III learned from a local resident that the Little Schuylkill River was being stocked with fish and contacted the Pennsylvania Fish Commission to validate this claim. The Commission stated that the river had been less acidic in the past few years and that the quality and quantity of aquatic life was improving. The Commission began stocking the river with brook and brown trout at various locations between Locust and Panther Creeks (directly north and south of Tamaqua) in 1983 and experienced limited success. The brown trout seemed to have suffered from chronic toxicity possibly from low pH levels or elevated concentrations of metals and sulfates. In 1984, the Commission only stocked the river with brook trout and was fairly successful. The Commission also stated that the Little Schuylkill River Conservation Club (a local fishing club) had been stocking the river with brook, brown, and rainbow trout, and bass and catfish for the past 5 years at Owl Creek (a stream a few miles south of Tamaqua). The club obtains its fish from the Fish Commission.

It is obvious that the river is severely affected by acid mine drainage north of LSR5. At points south of LSR5 though, it appears that a limited population of some macroinvertebrates and stocked fish can survive. Since stocked fish are consumed by humans, it is possible that a release of contaminants could affect not only aquatic like, but humans who ingest aquatic life. Biological uptake of contaminants by fish would depend on factors such as lipid content, uptake and depurgation rates, differences in metabolism, organism behavior (i.e. bottom dwelling, length of time in contaminated area), water temperature, dissolved oxygen level and the salinity in the water.

3. Surface Drainage Conditions

Since the mine spoil on-site is fairly permeable, most rainwater percolates into the mine spoil rather than running off-site. Surface water that does run-off generally flows from north to south on-site. There is severe erosional damage at the site as evidenced by several gulleys cutting into the coal refuse. Of major concern is the off-site migration of contaminants via surface water run-off. In addition to the previously listed organic and inorganic contaminants detected at various depths in soils on-site, a one acre resin sheet lies on the surface in the northern part of the site. This resin sheet appears to be one or two inches thick and contains the following compounds:

Contaminant	Concentration
styrene (tentatively identified)	10 - 100% *
alkane substituted benzenes (tentatively identified)	1 - 10%
branched chain hydrocarbons (tentatively identified)	1 - 10%
4-methyl-2-pentanone	1 - 10%
trichloroethylene	2.8%
1,1,1-trichloroethane	2.0%
naphthalene (tentatively identified)	1.3%
1,2-dichloropropane	1.2%
methyl ethyl ketone	0.1 - 1.0%
xylene (isomer)	"
methyl ethyl benzene (isomer)	"
trimethyl benzene	"
decane	"
toluene	0.64%
1,2-dichloroethane	0.63%
benzene	0.19%
tetrachloroethylene	0.12%
ethylbenzene	0.10%
acetone	0.01 - 0.10%
nonane	"
propyl benzene	"

* 1% = 10,000 ppm

4. Air Conditions

Air monitoring scans were performed over a 12-acre area on and near the site during the Remedial Investigation. Monitoring was done to determine the presence of radioactive substances, oxygen levels, and explosive and organic vapors. Results of these tests did not indicate the presence of any of these contaminants at above background levels. However, these findings particularly for organic vapors do not mean that some contaminants are not volatilizing from the site soil or the resin sheet since odors can be observed emanating from the site during warm summer days. Air sampling was not conducted during the summer. Since vapors can be observed during warm summer months and mutagenic compounds were detected in the resin sheet, it is possible that some low and undetermined health risk could result from the inhalation of vapors on-site. Another concern is the possibility that contaminants adsorbed to micron size soil particles could be dispersed via wind erosion and inhaled or ingested by persons travelling on or near the site. Particulate air sampling was not conducted during the Remedial Investigation, it is difficult to quantify this risk. Concern about ingestion or inhalation of airborne soil particles is based upon the observation of higher than background levels of organic and inorganic contaminants in soil. Many of these contaminants are suspected carcinogens and have cancer risk factors in the low parts per billion range. For example, beryllium was detected in surface soils at concentrations up to 28.0 ppm and is considered an industrial substance suspect of carcinogenic potential by the American Conference of Government Hygenists (ACGIH). The Time Weighted Average (TWA) for beryllium is 2.0 ug/m3 in air. The alternative National Emission Standard in 40 C.F.R. §61.32(b) for Hazardous Hazardous Air Pollutants lists a standard for beryllium at 0.01 ug/m3. It is difficult to determine whether air at the McAdoo Site is exceeding this limit or not.

5. Existing Storage Tank Waste

A presently secure 15,000 gallon storage tank containing approximately 1300 gallons of liquid and sludge hazardous waste remains on-site. Region III's Field Investigation Team (FIT) sampled the supernatant in June 1981 and detected: methylene chloride (140 ppm), a xylene isomer (probably ortho-xylene at 10 - 100 ppm), and unknown styrene (10 - 100 ppm), and bis(2-ethylhexyl) phthalate (450 ppm). Chemical Waste Management (representing one or more of the responsible parties) samppled the sludge during the same period and detected:

C9 - C17 hydrocarbons (80,000 ppm), xylenes (40,000 ppm), ethylbenzenes (8,600 ppm), toluene (3,000 ppm), and Total Halogenated Organics (3,600 ppm). Elevated vapor readings were observed in the manhole at the top of the tank using an OVM-FID on a day when the ambient temperature exceeded 80°F. If the contaminants listed above are inhaled, ingested, or come in contact with skin, liver damage, kidney damage or dysfunction, heart palpitations, or central nervous system damage could result. If long-term exposure occurs, these contaminants may cause cancer since some of these compounds are suspected carcinogens.

Remedial Action Alternatives Selection

Numerous remedial action alternatives were identified and evaluated during the Feasibility Study (FS) to address two site-specific remediation objectives. These objectives are:

- Prevent direct contact with on-site wastes (supernatant and sludge in the storage tank, and resin sheet) and contaminated soils. Direct contact is defined here as skin contact, ingestion, and inhalation of wastes and contaminated soils

- Prevent off-site migration of wastes and contaminated soils through surface water run-off, percolation to the mine pool, and wind dispersal.

Each alternative was studied and reviewed to determine its effectiveness in mitigating health or environmental concerns, technical feasibility, consistency with the National Contingency Plan and other environmental laws and cost. An initial screening of technologies was required to eliminate infeasible or inappropriate technologies from consideration.

The no action alternative for removal of tank content was rejected because the tank contents are in concentrated form and direct or prolonged contact with spilled wastes could cause acute, chronic, or long term health effects. The tank is presently secure, but its security can not be assured in the future. Rusting or vandalism may result in a significant release.

In reviewing treatment and disposal alternatives for wastes and contaminated soils, chemical, biological, and activated carbon treatment were rejected along with solidification of wastes and soils. Chemical treatment would involve technologies such as chemical oxidation, neutralization, ion exchange, and chemical dechlorination of extracted contaminants. Chemical treatment was removed from further consideration because treatment systems are not applicable to waste constituents on-site. Biological treatment involves seeding of a waste material with microorganisms to obtain degradation. This process is limited to contaminants which are biodegradable at a sufficient rate and soil which is naturally aerated or where artificial aeration is possible (it is assumed that compounds on site which will biodegrade undergo aerobic degradation).

Biological treatment was removed from further consideration because the the long-term effectiveness of this method is unknown. Activated carbon treatment was removed from further consideration because the contaminants found on site are adsorbed to soil. Incineration and wet-air oxidation were removed from further consideration because they would have eliminated organics but concentrated metal concentrations. On-site disposal in a RCRA landfill was removed from further consideration because the RCRA cap could provide similiar protection since the ground water table does not normally come in contact with the soils. The mechanism in which contaminants would come in contact with the ground water, except for subsidence, would be through downward migration from precipitation. The location of the landfill would also be susceptible to subsidence and difficulty in monitoring and would cost twice as much as a RCRA cap.

After completion of the initial screening of technologies, a detailed evaluation of alternatives was conducted in order to identify those alternatives which may best address the problems on-site in addition to removing the remaining 15,000 gallon tank. The chosen alternative should be the most cost-effective, technically feasible, and reliable solution that effectively mitigates or minimizes damage to and provides adequate protection of public health, welfare, and the environment. Alternatives were developed by applying technologies considered individually or in combinations.

The alternatives remaining after the initial screening process were grouped into two catergories: site related and disposal related acitivities. The alternatives are listed below:

° Site Related:

- No remedial action
- Removal of debris
- Excavation and/or removal of wastes and most heavily contaminated soil
- Excavation of contaminated soil to background levels
- Capping which meets the standard of RCRA regulations 40 CFR Part 264
- Diversion of surface water

° Disposal-Related

- Off-site disposal in an appropriate RCRA facility

These technologies were then combined in remedial alternatives that would be applicable to this site, and screened with respect to the remedial objectives. The following is a detailed analysis of these alternatives.

Alternative #1 - No Action

The No Action alternative was rejected because it would fail to prevent off-site migration of contaminants via wind dispersal, surface water, and ground water. The rationale for limiting off-site migration of contaminants via surface water and air dispersal were previously explained and need not be repeated. The following is the rationale for limiting migration of contaminants off-site via ground water flow:

As was previously mentioned, all rainwater or surface water run-on to the site which percolates through the site fill, follows the natural contour of residual soil and bedrock, enters the mine pool, and eventually discharges at the Silver Brook outfall. As was explained in the subsection on surface water conditions, the Little Schuylkill River is severely affected by acid mine drainage from the outfall. However, there are indications that the aquatic life may revive. The river is virtually devoid of aquatic life several miles downstream. The Pennsylvania Fish Commission and a local sporting club using fish from the commission stocks the river though at locations from Locust to Owl Creek with some success. EPA must consider the effect that the site could have on these fish and any other aquatic life which could eventually populate the river. If a pH adjustment treatment system were installed at the outfall, elevated levels of inorganics would precipitate from the acid mine drainage and the effulent might be of adequate quality to support a diverse community of aquatic life.

To determine the risk posed to present or future aquatic life in the river from the site, levels of contaminants in soils which could leach harmful levels of contaminants to the mine pool and eventually to the river must be calculated. (In other words, determining a safe level of contaminants in soil and observing whether concentrations detected on site exceed these levels.) This can be accomplished by first selecting target locations, then setting ambient water criteria for each contaminant to protect aquatic life or human health thru the ingestion of aquatic life, and finally calculating maximum levels of contaminants in soil which will not result in leaching of contaminants at levels which exceed these criteria. Since the resulting soil criteria is only a rough approximation, it is important to be as conservative as possible when establishing water criteria and using applicable calculations.

The Pennsylvania Department of Environmental Resources has stated that there is a possibility of mine subsidence at this site (see Appendix D). Mine subsidence has occurred at other mined out areas in the region. Without an extensive and comprehensive subsurface investigation, it is difficult to estimate the potential and resulting severity of an incidence of mine subsidence. Therefore, EPA will assume that an incident of significant mine subsidence is possible, but not likely, and that much of the site soil could come in contact with the mine pool water if catastrophic subsidence occurred. To be conservative, calculations were based on the worst-case scenario in order to protect the

environment in the case of catastrophic subsidence. Hence, calculations will assume that site soil is under saturated flow conditions. The target location for inorganics is at LSR5 near Locust Creek since this is the first downstream location where fish are stocked in the river. The outfall was not chosen as the target location because aquatic life will not survive there unless the pH is adjusted. If a treatment system is constructed and significant subsidence occurs, most of the released metals should be precipitated out at the treatment facility. The target location for organics is at the outfall since pH adjustment should not greatly affect the mobility of most organic compounds and it is assumed that someday the outfall discharge will be treated and enable aquatic life to survive near the outfall. Latest comments from the State indicate, that the State will probably address the outfall after the source of contamination from the McAdoo site is addressed.

Ambient water quality criteria for inorganic and organic compounds were established using current EPA criteria documents when available. When no criteria were available, other toxicological data were used to derive criteria. When no criteria was available, aquatic toxicological data was used (See Appendix A). The next Table lists criteria established to protect aquatic life and human health through the protection of aquatic life. The chosen water criteria was selected to be the lowest of the two values. See Appendix C for references which are shown in parenthesis.

For organics, the soil criteria was chosen using calculated water partition coefficients (Koc) illustrated on page 5 and chosen water criteria shown on the previous page. The two values were used in the Freundlich equation shown below which decribes the ratio of organic compounds expected in aqueous and soil media. An in depth discussion of adsorption and use of the Freundlich equation is presented in the Handbook of Chemical Property Estimation Methods copyright 1982 by McGraw Hill Inc. The organic carbon content was assumed to be 1.0%. Soils typically contain between 0.01 to 8% organic carbon. An organic carbon content value had to be assumed since analysis was not performed for this parameter in the coal refuse or residual soil during the remedial investigation. The fill and underlying soil is not expected to have a high concentration of organic carbon. A 10X dilution factor was added to the equation since any contaminants leaching would be diluted somewhat in the mine pool. No attempt was made to calculate a water dilution factor through water balance equations because the areal extent of the

Compound	Protection of Aquatic Life	Protection of Human Health thru Ingestion of Aquatic Life	Chosen Water Criteria
ORGANICS			
Acids			
phenol	2540(a)	NA	2540
4-methylphenol	541(j)	NA	541
Base/Neutrals			
Bis(2-ethylhexyl)phthalate	< 3(b)	50,000(u)	3
butyl benzyl phthalate	220(c)	NA	220
di-n-butyl phthalate	17.38(d)	154,000(u)	17
diethyl phthatlate	1240.5(e)	1,800,000(u)	1240
benzyl alcohol	580(k)	NA	580
isophorone	43,333.33(f)	520,000(v)	43,333
fluoranthene	1,592(g)	54(w)	54
naphthalene	NA	0.0311(x)	0.03
phenanthrene	"	"	"
chrysene	"	"	"
pyrene	"	"	"
benzo(a)anthracene	"	"	"
benzo(k)fluoranthene	"	"	"
benzo(b)flouranthene	"	"	"
dibenzofuran	12(l)	NA	12
Volatiles			
hexachloroethane	540(i)	8.74(y)	8
PCBs			
PCB-1248	0.014(z)	0.00079(z)	0.001
PCB-1254	"	"	"
INORGANICS			
beryllium	5.3(m)	0.117(l)	0.12
cadmium	1.2(p)	NA	1
chromium(+6)	11(n)	"	11
chromium(+3)	605.7(o)	"	606
lead	13.9(q)	"	14
nickel	775.9(r)	"	776
zinc	124.8(s)	"	125
cyanide	22(t)	"	22

NA - not available

mine pool is unknown. 10X is considered a conservative dilution factor.

$$x/m = Koc \times foc \times C^{1/n} \quad \text{(Freundlich equation)}$$

where:

x/m = maximum holding concentration of soil
Koc = soil adsorption coefficient
C = ambient water criteria
foc = fraction of organic carbon in soil

n = factor used in estimating curve for non linear isotherms
(note: when n =1, Freundlich isotherm becomes linear)

If it is assumed that n = 1, foc = 0.01, and a mine pool 10X dilution factor then:

$$x/m = 0.1\ Koc \times C$$

The following is a list the organic compounds detected on site, their maximum calculated safe concentrations in the case of catastrophic mine subsidence, and maximum levels detected in fill on-site.

Calculated Safe Levels of Contaminants in Soil(ppb) to Protect Aquatic Life in the Stream

Compound	Calculated safe Level	Highest Level Detected OnSite
Acids		
phenol	5,376	7,200
4-methylphenol	3,260	1,200
Base/Neutrals		
Bis(2-ethylhexyl)phthalate	32,146	960,000
butyl benzyl phthalate	7,230,652	104,000
di-n-butyl phthalate	145,000	3,400
diethyl phthaltate	127,100	1,063
benzyl alcohol	1,269	2,900
isophorone	150,251	2,800
fluoranthene	971,876	4,000
napthalene	87,172	680
phenanthrene	51	1600
chrysene	656	1600
pyrene	334	3800
benzo(a)anthracene	656	1300
benzo(k)fluoranthene	10,689	2,600
benzo(b)fluoranthene	6,190	2,600
PCB-1254	55	870
dibenzofuran	9,103	390
Volatiles		
hexachloroethane	1,311	1,600
PCBs		
PCB-1248	66	3,058

Soil criteria for metals can not be derived as easily as for organics. Metals will also adsorb to organic carbon (or to humic acids which may adsorb to organic carbon), but will also undergo other attenuating reactions such as complexation, precipitation, and cation exchange. Because of lack of field data and experience utilizing equations dealing with these mechanisms, a more simplistic approach was pursued in establishing soil criteria for inorganics. The highest levels of metals detected in background mine pool water (Big Gorilla Quarry) were compared with mean concentrations of metals expected in anthracite coal. This direct proportion relationship enables the calculation of the mean concentration of metal needed in anthracite coal to exceed previously established ambient criteria. A 15X dilution factor is then added (10X for mine pool and 5X for dilution from outfall to LSR5 (9.76 MGD/2.26-0.07 MGD = 4.5). Where inorganics were not detected in the quarry, the detection limit was used for calculation. See the data below and accompaning calculations.

Inorganic	Highest Level Detected in Quarry (ppb)	Background level in fill (ppm)	Calculated Soil Criteria (ppm)	Chosen Soil Criteria (ppm)	Maximum Concentration Detected on Site (ppm)
beryllium	< 10	2.2	0.4	2.2	28
cadmium	20	0.2	0.14	0.2	137
chromium	< 10	49.0	808.5	809	1370
nickel	1230	42.4	401.2	401	1720
lead	< 50	14	58.4	58	2830
zinc	270	20.7	143.5	144	48400
cyanide	< 10	< 1	33	33	44

For example in beryllium: $2.2 = \frac{10}{x \quad 0.12(15)}$ $x = 0.4$ ppm which is less than background, therefore the chosen soil criteria should only be 2.2 ppm.

See page 3 for references referring to background levels of metal in fill. Cyanide was listed as < 1 because it is not believed to occur naturally in coal. The calculation for chromium was based on Cr(+3).

This strategy is novel but reasonable and circumvents problems associated with the employment of cation exchange capacity (CEC) caculations for acidic conditions.

By comparing the calculated safe levels for inorganics and organics and comparing them to the maximum levels detected, we reject the No Action alternative.

Alternative #2 - Removal of Debris, Filling, Grading, Revegetation, and Diversion of Surface Water

This alternative would involve removing about 500 yds of surface

debris (ie: wooden pallets, and concrete slabs) to an appropriate landfill (if the material is found to be contaminated it will be disposed of in an appropropriate hazardous waste landfill) filling in depressions and erosional cuts with soil, covering the site with soil capable of supporting vegetation, revegetating, and constructing surface water diversion ditches to avoild future erosion. Off-site removal of debris is necessary to properly grade the site. The depth of cover soil should be a least six inches to avoid possible future direct contact or migration of contaminants via surface water run-off or wind dispersal should significant erosion occur at the site.

All aspects of this alternative involve well-established engineering practices but would not prevent future migration of contaminants to the mine pool. The construction time involved would probably not exceed two months. Land use after action would need to be restricted to activities which would not disturb the soil and cause mine subsidence. Adjacent land use would probably not be affected. Capital costs would consist of:

removal of debris: 500 yd3 x $50 / yd3 = $25,000

filling: 12907 yd3 x $10.00 / yd3 = $129,000 (assume depth of 1 foot over entire 8 acre area)

grading: 12907 yd3 x $2.62 / yd3 = $34,000

top soil: 6454 yd3 x $10.00 / yd3 = $65,000 (assume six inches)

seeding: 8 acres x $600 / acre = $5000

diversion ditches: (8 acres x $\frac{4840\ yd^2}{acre}$)$^{1/2}$ x 4 sides x 2 yd width x 1 yd depth x $9.90 / yd3 = $16,000 (assume ditches surround a square site)

removal of tank = $16,000

Total estimated capital cost = $290,000 (Cost figures obtained from EPA Handbook for Evaluating Remedial Action Technology Plans EPA-600/2-83-076)

This option would reduce the possibility of direct contact with wastes and contaminated soil and would prevent off-site migration of contaminants via surface water and wind dispersal. The option would not reduce the percolation of run-on surface water and rain water through site soil or address the risk of releasing contaminants to the mine pool in the case of catastrophic mine subsidence. The basis for considering mine subsidence and corresponding safe levels of contaminants in soils was previously established. The risk of contaminants migrating to the mine pool from site fill from surface water run-on and rain water percolation is more

difficult to quantify. Site soils were shown to contain higher than background levels of organics and inorganics. However, data collected during the Remedial Investigation is insufficient to determine the present mobility of contaminants in soil especially in regard to inorganics. Samples taken in test pit areas where the highest concentrations of metals were detected were shallow (less than 3 feet). of beryllium, chromium, and zinc detected in the mine pool seem elevated and may indicate present leaching of some contaminants. It is also possible that most contaminants are presently situated in shallow soils and are slowly migrating downward to the mine pool which could result in a future release of contaminants to the mine pool.

Alternative # 3 - Removal and Disposal of Debris, Filling, Grading, Capping, and Diversion of Surface Water

This alternative involves the removal of approximately 500 cubic yards of debris with disposal in an appropriate landfill, filling in depressions and erosional cuts with soil, grading the entire site for capping, capping the site in accordance with current RCRA requirements, and constructing surface water diversion ditches to protect the cap. The debris would be removed to assure proper construction of the cap and avoid possible settling due to degradation of some debris. Since the possibility of mine subsidence is a concern, the cap should be designed to withstand minor subsidence. As in alternative #2, surface water diversion ditches would be constructed to avoid future erosional problems.

All aspects of this alternative are considered well established engineering practices. The reliability of the cap should be maintained except in the case of catastrophic subsidence. A mine subsidence study would be necessary to better define cap design.

The principal disadvantage of leaving contaminated soils in place under the cap involves of the possiblity of mine subsidence as previously discussed and its likely effects on the cap (i.e. collapse, cracking). Minor subsidence could probably be repaired, but EPA is considering the possibility of significant mine subsidence which could cause unrepairable damage to the cap. The construction time involved in this alternative would probably not exceed four months. Land use after action would need to be restricted to non-soil disturbing activities and activities which would not cause mine subsidence. Adjacent land use would probably not be affected. Capital costs would consist of similar actions discribed in alternative #2, except that an impermeable clay cap would be installed over the entire site:

removal of debris:	$25,000
filling:	$129,000
grading:	$34,000
seeding:	$5,000
diversion ditches:	$16,000
	$209,000

plus cap costs:

(2 ft cover soil) x $\frac{4840 \text{ sq yds}}{\text{acre}}$ x (8 acres) x $\frac{1 \text{ yd}}{3 \text{ ft}}$ x $\frac{\$10.00}{\text{yd3}}$ = $258,000

(note: Depth of soil cover required varies with the frost line. For calculations, 2 feet is assumed)

(1 ft sand for drainage layer) x $\frac{4840 \text{ sq yds}}{\text{acre}}$ x (8acres) x lyd x $\frac{\$18.15}{\text{yd3}}$

= $234,000

(2 ft clay) x $\frac{4840 \text{ sq yds}}{\text{acre}}$ x (8acres) x $\frac{\text{lyd}}{3 \text{ ft}}$ x $\frac{\$16.29}{\text{yd3}}$ = $420,000 (if clay is needed)

removal of tank = $16,000

Costs for a subsidence study including costs for drilling 5 borings $50,000

Therefore, total capital costs = $1,187,000.

Since the mine pool water does not come in contact with the site fill, an impermeable cap would hydraulically isolate the site and provide a high degree of protection. However, as stated, there is an unquantified or unknown chance of catastrohpic mine subsidence which could provide a route for future migration of contaminants to the mine pool. If a cap was constructed, a comprehensive inspection and maintenance would have to be developed to ensure that subsidence would be detected and any significant breaches repaired. Minor subsidence would be difficult to detect, but depending on the swelling properties of the clay, may not result in a breach of the cap.

Since there is a possibility of subsidence, the cap alone may not provide adequate protection. Long term operation and maintance would be required.

Alternative #4 - Excavation of Contaminated Soil Exceeding Criteria Developed in the No Action Alternative with off-site Disposal in a RCRA Regulated Landfill

This option involves removing about 500 cubic yards of surface debris with disposal in an appropriate landfill, excavating any contaminated soils or wastes which exceed criteria developed in the No Action Alternative with off-site disposal in a RCRA regulated landfill, filling with soil, grading, covering with a layer of soil capable of support vegetation, and revegetating.

This alternative is considered technically feasible but may be difficult to implement. Numerous soil samples were taken from test pits during the Remedial Investigation in an attempt to characterize and delineate the areal extent and depth of contamination. The sample results indicated many areas of

organic and inorganic soil contamination but obviously could not identify contamination in every cubic yard on site. Even if all soils sampled in test pits exceeding the previously established criteria for inorganics and organics were excavated there would still be a substantial amount of soil not sampled which may exceed criteria. Therefore, either a substantial amount of further sampling should be incorporated into this alternative to better identify the location of contaminants or an alternative excavation strategy should be proposed. Since soil samples can cost over $1,000, it seems prudent to propose a strategy which will minimize sampling and at the same time remove most of the contaminated soil exceeding the established criteria. One strategy considered would involve identifing test pit locations and depths which contained soil exceeding criteria and excavating to that depth. Since the test pit sample is only an indication of contamination which may exist in that entire area, excavation should extend over some area which will collect most of the contaminated soil. One strategy might be to excavate over a 50' by 50' area at certain selected depths and then sample at the edge of each excavated pit to ensure that remaining soils do not exceed criteria. The exact methodology for excavation will be defined during design, but it may be useful at this point to roughly estimate the amount of soil that may be excavated so that a rough approximation of cost can be described. Also, it should be recognized that the risk model used to develop safe soil levels and contaminants may also be further refined during design. The next page contains a description of contaminants detected on site in various test pits which exceed the inorganic and organic criteria and an estimate of soil removal.

All excavated soil would have to be placed in a RCRA facility in accordance with current EPA off-site disposal policy. lined landfill in accordance with current EPA off-site disposal policy. It is estimated that disposal in a RCRA landfill could cost $200 per cubic yard. If it is assumed that no other soils fail the criteria and only soils outlined in the next page will be removed (5898 cu yds) then removal of waste and soil alone could cost $1,179,000. If it is assumed that at least 4 priority pollutants samples are taken near each test pit marked for excavation (11 test pits) then sampling alone could cost $44,000. (Priority Pollutant samples cost approximately $1000.00 each)

Total costs for Alternative #4 are estimated as follows:

excavation and removal of contaminated soils = $1,179,000
further sampling = $44,000
removal of debris = $25,000
grading = $34,000
seeding = $5,000
diversion ditches = $16,000
six inches of cover soil = $65,000
filling = $129,000
removal of tank = $16,000

Total capital costs = $1,513,000.

Contaminant	Test Pits and Depth of Contamination (feet) Test Pits Numbers :													
Organics	3A	9	10	11	12	14	17	18	19	24	25	28	29	33
Hexachloroethane														10
PCB-1248						2.3 (Depth)				1.5				
PCB-1254									3		2.5			
phenol											2.5			
phenanthrene								2		12				3
chrysene														3
pyrene								2						
benzyl alcohol		1.5												
Inorganics														
beryllium						2.3				14				
nickel						2.3					1.5			
cadmium		4	4.5	0.5		2.3	2	2	3	14	7			
chromium														
zinc			4.5			2.3	2			12	1.5			3
lead	1					2.3	2		3		2.5			10
cyanide			4.5											
Estimated Depth of Removal (feet)	1.5	4.5	5	1	0	3	2.5	2.5	3.5	14	7.5	0	0	10
Estimated Volume of Removal (yd3)	139	417	463	93	0	278	231	231	324	1296	694	0	0	926

= 5,092 cu yds

resin sheet = 1 acre x $\frac{4840 \text{ yd}^2}{\text{acre}}$ x 1/2ft x $\frac{1\text{yd}}{3\text{ft}}$ = 806 cu yds

Total estimated removal of soil and waste based on test pits alone and assuming no other soils fail criteria = 5898 cu yds

Alternative #5 - Combination of Alternatives #3 and #4

Alternative #5 involves removal and disposal of debris, excavation of wastes and contaminated soil exceeding criteria, filling, grading, constructing a RCRA cap, and diversion of surface water. A mine engineering study would be conducted to determine the risk and magnitude of mine subsidence and assist in appropriate cap design. This alternative offers the greatest protection to aquatic life in the Little Schuylkill River when compared to the previously discussed alternatives. The placement of an impermeable cap would eliminate any present or future potential migration of contaminants from site fill under conditions other than catastrophic mine subsidence, and if catastrophic subsidence occured, excavation of the highest concentrations of contaminated soil would minimize any impact on the river. This alternative is viewed as providing an adequate protection and achieves the stated objective to mitigate any present or future migration of contaminants from the site.

Capital costs for Alternative #5 are as follows:

removal of debris = $25,000
further sampling = $44,000
excavation and removal of contaminated soils = $1,179,000
grading = $34,000
seeding = $5,000
diversion ditches = $16,000
filling = $129,000
removal of tank = $16,000
clay cap = $420,000
drainage layer = 234,000
2' cover soil = $258,000
mine subsidence study = 50,000

Capital costs = $2,410,000

Total costs could substantially increase if more than 5893 yd3 of waste and soil are removed or if the cap should fail.

Alternative #6 - Excavation of Contaminated Soils to Background Levels

This alternative would involve identifying all soils which contain contaminants above background levels and removing these soils off-site to an appropriate RCRA facility. Identifying all contaminated soil would be difficult and involve taking hundreds of additional samples costing several hundred thousand dollars. Excavating contaminated soil would involve standard reliable engineering practices. Since all contaminated soil would be removed, there would be no future health or environmental impacts risks posed by the site. Future use of land would only be restricted to geological limitations posed from past deep mining.

The costs of this alternative would be very high and would not provide significantly more human health or environmental protection as compared to other alternatives. In calculating capital costs, it is assumed that only one-half of site soil contains contaminats above background levels in soil.

The amount of contaminated soil on site may well be greater. The following is an estimate of capital costs involved in alternative #6. There should be no O $ M costs incurred at this site.

removal of soil:

$$1/2 \times 8 \text{ acres} \times \frac{4840 \text{ yd2}}{\text{acre}} \times 8 \text{ ft avg. depth} \times \frac{1 \text{ yd}}{3 \text{ ft}} \times \frac{\$200}{\text{yd3}} = \$10,325,000$$

additional sampling: (assume one sample per 20 yd3 - actual frequency may change during design)

$$8 \text{ acres} \times \frac{4840 \text{ yd2}}{\text{acre}} \times 8 \text{ ft} \times \frac{1 \text{ yd}}{3 \text{ ft}} \times \frac{\$1000}{\text{sample}} \times 1/20 = \$5,163,000$$

filling:

$$1/2 \times 8 \text{ acres} \times \frac{4840 \text{ yd2}}{\text{acre}} \times 8 \text{ ft} \times \frac{1 \text{ yd}}{3 \text{ ft}} \times \frac{\$2.00}{\text{yd3}} = \$103,000$$

plus:

removal of debris = $25,000

grading = $33,000

total costs = $15,649,000

Consistency With Other Environmental Laws

The six alternatives presented in this ROD were evaluated to determine consistency with RCRA regulations, 40 CFR Part 264, as described. Because consideration and selection of a remedial response regarding the decision on ground water and possible off-site sediment contamination in the Little Schuylkill River is being deferred, consistency with RCRA for these two concerns was not examined.

EPA examined the remedial alternative with respect to their consistency with 40 CFR 264.310(a). In order to comply with the cover requirements of this regulation, a final cover must be placed which is designed and constructed to:

(1) Provide long-term minimization of migration of liquids through the closed landfill;

(2) Function with minimum maintenance;

(3) Promote drainage and minimize erosion or abrasion of the cover

(4) Accomodate settling and subsidence so that the cover's integrity is maintained; and

(5) Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.

The preferred alternative relies principally on the construction of a cover that is consistent with EPA's engineering specifications for constructioning the RCRA cover required by 40 C.F.R. §264.310(a). The cover is EPA's standard method of preventing the migration of pollutants to the ground water. The preferred alternative will also involve excavation of soils exceeding the established criteria to the extent described in the ROD to provide additional protection. Residual soils remaining on-site will have a minimal impact on human health and aquatic life if mine subsidence occurs. These measures will provide long-term minimization of migration of liquids through the closed landfill [40 C.F.R. §264.310 (a) (1)] and accomodate settling and minor subsidence so that the cover's integrity is maintained [40 C.F.R. §264.310 (a) (4)].

The technical feasibility of ground water monitoring is in question, but will be considered during the next operable unit since the decision concerning remedial action for the ground water and surface water have been deferred at this time.

Recommended Alternative

Section 300.68 (j) of the National Contingency Plan (NCP) [47 FR 31180, July 16, 1982] states that the appropriate extent of remedy shall be determined by the lead agency's selection of the remedial alternative which the agency determines is cost-effective (i.e., the lowest cost alternative that is technologically feasible and reliable and which effectively mitigates and minimizes damage to and provides adequate protection of public health, welfare, and the environment). Section 101(24) of CERCLA states that off-site transport of hazardous substances is not appropriate unless it is "more cost-effective than other remedial actions" or "necessary to protect public health or welfare or the environment from a present or potential risk which may be created by further exposure to the continued presence of such substances." Based on our evaluation of the cost-effectiveness of each of the proposed alternatives, the comments received from the public, and the state and information from the Feasibility Study, we recommend that Alternative #5 be implemented. This alternative includes removal of the on-site tank, debris and the resin-like material and contaminated soils exceeding guidelines as discussed previously to an off-site RCRA regulated facility. The site would then be filled, graded, and overlain with RCRA cover. Diversion ditches would also be constructed around the site to divert surface water run-on and prevent erosion. Operation and maintenance would be

of the cap and surface water ditches and sampling of the monitoring wells and Silverbrook mine discharge point. The State of Pennsylvania requested that we add lime into soil for any remedy other than total excavation. This will be reviewed during the design phase to determine if it should be utilized to enhance the remedy.

The No Action Alternative was rejected because Alternative #1 would fail to prevent off-site migration of contaminants via surface water, wind dispersal, and ground water. The No Action alternative would also fail to address the protection of future adjacent land users against acute, chronic, and long term health effects.

Alternative #5 was chosen instead of Alternative #2 because Alternative #2 would fail to prevent percolation of rain water through the site fill, and does not address the possibility of release of contaminants in the event of catastrophic mine subsidence.

Alternative #5 was chosen instead of Alternative #3 because there may be a possibility of future catastrophic mine subsidence that would allow contaminants to migrate to the mine pool.

A comprehensive mining engineering study to determine appropriate cap design taking into account the risk and magnitude of mine subsidence for this site will be undertaken during the design stage. If the study shows that subsidence sufficient to cause significant cap damage can not be reasonably expected to occur at the McAdoo site, then reevaluation of the remedy may be considered. If the remedy is changed, a ROD amendment would be required.

Alternative #5 was chosen instead of alternative #4 because under alternative #4, rainwater and surface water run-on could still percolate through lesser contaminated soils and cause possible future migration of contaminants to the mine pool. Also, some soils exceeding criteria may remain after excavation.

Alternative #5 was chosen instead of alternative #6 because it can achieve adequate levels of protection to public health and environment for substantially less expense.

Capital Cost

The capital cost of Alternative #5 is estimated to be $2,360,000

Project Schedule

Approve Record of Decision	June, 1985
Start Design	August, 1985
Complete Design	April, 1986

Approve State Superfund Contract for Construction	May 1986
Start Construction	June, 1986
Complete Construction	December, 1986

Future Actions

Decisions regarding remediating and monitoring ground water flowing in the mine pool and sediment in the Little Schuylkill River have been postponed pending further evaluation.

Alternative	Components	Cap.	O&M	Considerations	Considertions	Considerations	Other
Alternative #1	No Action	-0-	-0-	Soil migrating offsite via surface water runoff and wind dispersal may cause a threat through direct contact or inhalation of harmful particulates.	Soils migrating offsite via surface water runoff and ground water flow may further degrade the Little Schuylkill River.	None	Very unacceptable to the public
Alternative #2	Filling, Regrading Revegetation and Diversion of Surface Water	290	*	Will prevent direct Contact and inhalation of harmful pollutants	Will prevent offsite migration of soils and waste via surface runoff but not prevent additional migration of contaminants to the mine pool.	Based on well established engineering practices	Unacceptable to public. Acceptable to PRP's
Alternative #3	Cap and Divert Surface Water	1,187	*	Same as 2	Will prevent offsite migration of soils and waste via surface water runoff. Will greatly reduce migration of contaminants to mine pool. Mine subsidence might breach cap and cause release to mine pool.	Same as 2	Probably not acceptable to public. Land use limited after action. Unacceptable to State. Probably acceptable to PRP's.
Alternative #4	Excavation with Offsite Disposal and Divert Surface Water	1,513	*	Same as 2	Lesser contaminated soil would remain onsite and be exposed to infiltrating rainwater nd round water inflow	Same as 2	Acceptable to public. Land use limited after action. Probably not acceptable to PRP'.

Alternative #5	Limited excavation with Offsite Disposal, Capping and Diversion of Surface Water	2,410	*	Same as 2	Same as 3 except that the highest concentrations of the most mobile soil contaminants would be removed to provide protection against mine subsidence and migration of contaminants to the mine pool.	Same as 2	Probably accept to public. Lan limited after a RP's probably w accept.
Alternative #6	Excavation to back ground levels	15,649	-0-	Protects public health	Protect environment	Same as 2	Very acceptable Not acceptable

* To be determined

Community Relations Responsiveness Summary
McAdoo Associates Site

EPA, Region III, completed a Remedial Investigation (RI) in May, and prepared a draft Feasibility Study (FS) in June, 1984 for the McAdoo Associates Site. The Region provided copies of the RI/FS and notified the public through a press release two weeks prior for a July 11, 1984 public meeting. The RI and draft FS were distributed to three community repositories: Kline Township Building, Kline Township Fire Hall, and the McAdoo-Kelayers Elementary School. The meeting was held at the McAdoo-Kelayers Elementary School to elicit citizen views about the findings of the Remedial Investigation and describe cleanup alternatives developed during the FS.

During the public meeting, the region provided copies of the FS free of charge. The region informed the public of the August 13th comment deadline and strongly encouraged the submittal of written comments to the EPA regional community relations coordinator. Several citizens gave speeches during the three hour meeting expressing their concerns about the adequacy of the RI and eventual choice of a FS option.

The region received many written comments during the public comment period from citizens, local officials, and environmental groups in addition to a petition containing approximately 3400 signatures. The following is a brief summary of all written comments received during the public comment period and the region's response.

1. Comment: State Senator Rhoades Date of Letter: 7/27/84

   - "All contaminated materials, soils and storage tanks (should be) removed from site and area.

   Response:

   - The Region considered excavation of contamineated soil to backgrond level but judged this alternative as being unnecessary to protect public health and the environment. The Region estimated that this option requires the excavation and removal off-site to a RCRA regulated facility of approximately 103,253 yd3 probably costing over 30 million dollars. The Region believes that several far less costly alternatives are available which could provide adequate public health and environmental protection.

   Date of Letter: 8/06/84

   - Requested meeting with EPA and Tamaqua Borough, Schuylkill County, and McAdoo and Kline Township officials to discuss the fingings of the RI/FS.

Reponse:

- The Region advised State Senator Rhoades that the July 11, 1984 public meeting was conducted to discuss findings in the RI/FS. The Region encouraged Senator Rhoadès to submit further comments in writing to the Region's Community Relations Coordinator.

Date of Letter:
8/2/84

2. Comment: Schuylkill County Board of Commissioners

- Wished to meet with EPA representatives to discuss site cleanup.

Response:

- The region also encouraged the Board of Commissioners to submit further comments in writing to the Region's Community Relations Coordinator.

Date of Letter:
7/17/84

3. Comment: Borough of McAdoo

- complained that:

  - Inadequate notice had been given for the public meeting
  - The RI/FS is not clear and concise
  - EPA did not consult with local workers previously employed by the facilities
  - EPA and PADER paperwork is delaying the cleanup
  - EPA and PADER not acting in an honest manner
  - EPA and PADER personnel not qualified to conduct environmental investigations
  - PADER caused situation by not properly monitoring the site operations prior to closure

- believes that chemicals were dumped or buried farther off-site than investigated during the RI

- wants "total excavation of the site... and that the contaminated soils be removed out of state... as far away from our area as possible".

Response:

- The region notified the public of the July 11th meeting through press releases two weeks prior to the meeting.

- The Region's consultant attempted to contact local miners when investigating mine tunnels.

- Preliminary headspace analysis screening of soils adjacent to the site gave no indication of significant volatile contamination, however, elevated levels of metals may be present. This will be investigated during implemention of the chosen remedial action.

- Total excavation comment previously discussed.

Date of Letter:
7/16/84

4. Comment: Concerned Citizens of Schuylkill County

- area not appropriate for construction of a landfill (referring to on-site disposal with RCRA landfill alternative) because of extensive underground mining under site and in vicinity.

- northern and northwestern section of site is intersected by State highways (81 and 309) which required drilling and blasting for construction. Therefore, rock strata are fractured in area. (Probably referring to cemented sandstone Pottsville formation which prevents contaminated ground water from migrating to deeper aquifers).

- site is near three major surface water sources supplying drinking water to the area. Still Creek Reservoir is 1 1/2 miles southeast of the site, and supplies water for the towns of Tamaqua and Hometown. Quakake Creek lies several hundred yards north of the site and empties into the Hudsondale dam, a major water source for Hazleton. Also, the site is 1 1/2 miles south of the Honeybrook Water Company well which may have a cone of depression over 1 mile.

- wants "[removal of] all remaining toxic wastes, contaminated soils and any other buried waste...to a... landfill out of [the] area."

Response:

- The RCRA LF was eliminated from evaluation since it would provide similiar protection as a RCRA cap for approximately double the cost.

- In regard to rock strata fractures from blasting, it is unlikely such blasts could sufficiently fracture several hundred feet of Pottsville sandstone to allow downward migration of contaminants. Local fracturing, however, is possible. EPA believes that no drinking water supply is threatened by the site since all water percolating through the site migrates to the mine pool which eventually discharges to the Little Schuylkill River. The Little Schuylkill River is not used nor does it flow into any reservoirs which are used for drinking water.

5. Comment:

Date of Letter:
8/9/84

- Concerned Citizens of Schuykill County, Citizens against Hazardous and Nuclear Waste, 924 Citizen Committee, and the Little Schuykill Conservation Club.

- Submitted photocopied petition containing about 3400 signatures demanding the following:

  ° further investigation of the site
  ° water samples taken from:

    - Big Gorilla (abandoned water filled mine quarry)
    - Hollow Creek
    - Quakake Creek
    - Haddock Creek
    - Still Creek Reservoir
    - Hudsondale Reservoir
    - homes in:

  ° Ginter
  ° Quakake
  ° Hometown
  ° Still Creek
  ° Lofty
  ° Tamaqua
  ° Haddock

  with split samples given to the committees
° more monitoring wells installed at the site and other areas previously specified
° more soil samples taken from the site and other areas previously specified
° Constant testing of the McAdoo, Hudsondale, and Still Creek Reservoirs
  with split samples provided to the committees
° air monitors installed to check vapors coming from site
° health survey from McAdoo thru Tamaqua

Response:

- The Region does not believe it necessary to sample the creeks, reservoirs, or home areas listed, because as previously stated, all water percolating through the site migrates to the mine pool which eventually discharges to the Little Schuylkill River which in not used or flowing into any reservoir used for drinking. The Region will address the need for ground water and surface water treatment in the future. The Region is also confident that it has properly characterized the subsurface geology and ground water flow patterns underneath the site and surrounding area, and at this time additional monitoring wells are not needed to characterize the site.

- During implementation of the recommended cleanup alternative, further soil sampling and air monitoring will be necessary.

- The request for a health survey was referred to the Region's Centers for Disease Control (CDC) representative.

Date of Letter:
7/24/84

6. Comment: Mary Magda

   - wanted further investigation at the site and re-evaluation of the Silverbrook wells
   - complained of acrid odors from site
   - stated that residents have a high incidence of cancer and other illnesses
   - wanted removal of all contaminated soil and waste with off-site disposal

Response:

1. The chosen remedial alternative should eliminate any odors from the site.
2. During excavation, odors may emanate. Air monitoring will be conducted during implementation to assure that levels do not exceed safe standards.
3. Additional soil sampling will be conducted during excavation to determine excavation limits.

Date of Letters:
7/18/84

7. Comment: Photocopied Letters from 32 Citizens

   - "want...all the contaminated soil and remaining chemicals removed from area.

   Response:

   - Comment previously addressed

Date of Letters:
7/14/85

8. Comment: Letters form Two Other Citizens

   - wanted complete off-site disposal of all contaminated soil and debris

   Response:

   - Comment previously addressed

9. Comment: Phone calls from Mrs. Clymer
   (Resident of Silverbrook Road)

   - Throughout the comment period, the region received phone calls from Mrs. Clymer who lives on Silverbrook Road which is located a few hundred yards north of the site. She was concerned about the possibility of the site causing contamination of her well on Silverbrook Road. The Regional

Project Manager explained that the RI had concluded that it is very unlikely that water originating from the site could reach residential wells on Silverbrook Road. However, sampling of the wells during the RI detected silver at 86ppb at a neighbor's well and higher than normal levels (62 & 82ppb) of nickel in her well. Also, a May 1982 PADER sampling of those wells detected cyanide at 50 and 51ppb in each well. The well containing silver was resampled by EPA in June 1984 for inorganics; silver was not detected. The region does not believe that the elevated levels of inorganics detected in residential wells on Silverbrook road are coming from the site. A preliminary assessment site and site inspection will be conducted seperate from the McAdoo study to investigate the situation.

Date of Letter:
8/13/84

10. Comment: David W. Marston, Attorney at Law

- Requested that Potential Responsible Party (PRP) Committee be afforded the opportunity to review and comment on the proposed ROD prior to its submission for adoption

- Wants the site rescored (Hazard Ranking System) based on findings of RI. Their consultant, Fred C. Hart Associates, now score the site at 3.09 as compared to the original score of 71.99.

- Feasibility Study does not contain a rating of effectiveness and cost.

- FS does not contain an analysis the cost-effectiveness of each alternative

- The RI concludes there is and has been on ground water contamination from waste management activities at the site.

- In the description of rotary kiln incineration alternative, the FS states that residue will be considered nonhazardous. Unless the residue is delisted it is presumed to be a hazardous waste for purposes of ultimate disposal.

- Rotary kiln incineration and wet-air oxidation are not cost-effective and increased environmental risks associated with excavation and handling of contaminated soil and waste prior to treatment, and the emissions and water discharges that will result make these alternatives unacceptable.

- The alternative describing the using of an on-site RCRA landfill states that approximately 12,000 cubic yards of debris would be landfilled while the non-RCRA landfill alternative states that only 300-500 cubic yards of debris would be landfilled.

- "The associated environmental consequences of on-site landfilling such as reconcentrating the wastes and their added handling would only exacerbate conditions at the site."

- "With respect to the off-site disposal alternative, the FS concludes that the most likely candidate for disposal is the the CECOS International Site near Buffalo, New York, approximately 400 miles from the McAdoo site. No consideration is given to other possible sites."

- Off-site disposal runs counter to EPA's current policy restricting the use of off-site land disposal facilities.

- FS does not contain explanations of how cost estimates were determined nor is there any consideration of the long term costs and obligations associated with the alternatives

- "Based on the NUS studies, the McAdoo site poses little or no risk to public health or the environment."

- They support remediation no more extensive than:

  - removal of the 1300 gallons of liquids and surface debris to an approved disposal facility
  - provision of surface water run-off control
  - filling, regrading and revegetating

Response:

- It is not current EPA policy to allow potential responsible parties an opportunity to review and comment on the proposed ROD prior to its submission for adoption. However, the PRP's comments on the RI/FS are taken into account in EPA's selection of the remedial alternative.

- EPA scores sites for inclusion on the NPL based on hazards that existed prior to any response actions. Scoring a site on the basis of the latest conditions could encourage incomplete solutions that might leave significant health or environmental threats unaddressed.

- The FS as suggested does not have a detailed breakdown of costs for each remedial option which is a shortcoming of this study. The study did provide an estimate of present worth long term operation and maintenance costs. EPA, however, utilized the Handbook for Evaluating Remedial Actions Technology Plans to better define the costs in the ROD.

- Evidence obtained from the RI suggests that there is a potential for ground water contamination from waste management activities at the site.

- The Region agrees that incineration is not cost effective.

- As pointed out, there does seem to be a discrepancy in the volume of soil to be excavated in the RCRA and Non-RCRA alternative. The on-site RCRA landfill should involve the excavation of approximately 12,000 yd3 of soil and 300-500 yd3 of debris.

- On-site landfilling of contaminated soils or waste would not exacerbate conditions at the site if the wastes or soils were properly isolated (air, direct contact, groundwater, surface water) as could be provided in a RCRA landfill if it could be located effectively.

- During the Feasibility Study, other off-site disposal locations were considered besides the CECOS International site but not mentioned in the report.

- EPA does have a current policy which recommends that on site treatment or disposal be considered in lieu of off site disposal when technically feasible and cost-effective. The proposed remedy does not leave all the waste at the site due to the possibility of catastrophic mine subsidence.

- As discussed in the ROD, the Region disagrees with the conclusion that the site poses no risk to public health or the environment. The chosen remedial alternative will rectify this situation.

- The Region acknowledges the PRP Committee's recommendation for remedial action at the site and considered it with other alternatives presented in the Feasibility Study.

11. Comment: Joseph M. Polito, Attorney at Law — Date of Letter: 6/14/85

Submitted a voluminous package of comments mainly concerning the risk and magnitude of mine subsidence and the validity of EPA's chosen soil criteria for contaminants. The most important comments are summarized as follows:

- mine subsidence is very improbable and even if subsidence occurs, complete saturation of the contaminated fill is unlikely.

- the mine pool dilution factor should be approximately 400 instead of 10.

Response:

- As the ROD states "a comprehensive mining engineering study to determine appropriate cap design, taking into account the risk and magnitude of mine subisdence for this study will be undertaken during the design stage. The information submitted will be evaluated in conjunction with information from the State during the Design Phase. Collection of additional information concerning the potential for mine subsidence may be necessary. If the study, shows that subsidence sufficient to cause significant cap damage cannot be reasonably expected to occur at the McAdoo site, then reevaluation of the remedy may be considered."

- In reference to mine dilution factor, it should be recognized that the risk model used to develop the safe soil levels of contaminants may be further refined as additional data is collected during the design stage. If a dilution factor greater than 10 is valid, then a higher value would be incorporated.

- See Appendix E for additional comments and responses to PRP comments submitted June 15, 1985.

Appendix A

DOE-30013-F10
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A DATA BASE FOR THE ANALYSIS OF COMPOSITIONAL CHARACTERISTICS OF COAL SEAMS AND MACERALS

Final Report - Part 10

VARIABILITY IN THE INORGANIC CONTENT OF UNITED STATES' COALS - A MULTIVARIATE STATISTICAL STUDY

by
David C. Glick and Alan Davis

Coal Research Section
The Pennsylvania State University
University Park, Pa. 16802

PREPARED FOR
UNITED STATES DEPARTMENT OF ENERGY
Under Contract No. DE-AC22-80PC30013

Table 6. Summary Statistics for Variables of Eastern Province Coals by Region (Whole-Coal Basis)

Variable	Appalachian Region Samples					Anthracite Region Samples				
	Minimum Value	Maximum Value	Mean	Standard Deviation	n*	Minimum Value	Maximum Value	Mean	Standard Deviation	n*
Si, %	0.390	8.218	2.918	1.827	146	1.121	7.217	4.332	1.927	12
Al, %	0.325	6.113	1.890	1.160	146	1.028	4.753	2.743	1.259	12
Ti, %	0.015	0.613	0.112	0.084	146	0.029	0.351	0.208	0.106	12
Fe, %	0.090	11.408	1.768	1.543	146	0.148	1.277	0.453	0.319	12
Mg, %	0.010	0.201	0.062	0.044	146	0.010	0.101	0.052	0.025	12
Ca, %	0.022	1.007	0.143	0.129	146	0.014	0.091	0.052	0.023	11
Na, %	0.009	0.140	0.033	0.021	146	0.007	0.102	0.038	0.026	12
K, %	0.003	1.271	0.230	0.204	146	0.080	0.652	0.338	0.170	12
P, %	0.001	0.229	0.023	0.035	146	0.002	0.040	0.011	0.011	12
Ba, ppm	7.650	532.532	117.469	98.213	146	43.699	196.821	113.527	48.015	12
Be, ppm	0.280	13.202	2.323	1.725	145	0.618	5.755	2.206	1.609	12
Cr, ppm	3.046	99.084	25.546	16.098	145	13.300	75.608	48.998	18.159	12
Cu, ppm	2.493	85.703	20.562	13.910	146	10.925	73.317	30.521	16.307	12
Ga, ppm	0.954	26.445	6.580	4.218	82	4.674	27.494	12.105	7.374	8
La, ppm	1.658	29.713	9.560	5.869	82	7.575	30.363	21.013	8.315	8
Mn, ppm	2.139	677.030	37.096	88.940	145	3.325	95.918	27.240	29.442	12
Ni, ppm	3.239	179.113	21.134	19.776	145	10.925	126.835	42.425	30.860	12
Rb, ppm	0.888	73.071	13.926	12.649	144	0.793	47.270	20.678	12.854	12
Sc, ppm	0.589	14.266	4.603	2.619	82	4.281	16.807	9.278	4.202	8
Sr, ppm	8.934	627.627	113.430	105.298	146	5.252	91.576	39.978	32.946	12
U, ppm	0.102	10.204	1.309	1.134	142	0.604	5.221	2.026	1.286	12
V, ppm	4.547	99.084	30.477	19.356	146	15.675	142.052	51.558	36.012	12
Y, ppm	2.487	27.368	10.762	5.060	82	5.549	29.785	17.004	8.191	8
Yb, ppm	0.264	3.097	1.430	0.635	82	0.713	3.208	1.894	0.933	8
Zn, ppm	2.411	99.916	22.921	19.479	144	2.850	65.653	20.729	19.745	12
Zr, ppm	5.279	215.260	34.080	24.295	146	9.975	120.857	61.041	40.999	12
Pyritic S, %	0.010	5.870	1.407	1.301	142	0.020	1.230	0.267	0.339	12
Sulfate S, %	0.000	0.490	0.077	0.104	146	0.000	0.070	0.019	0.024	12
Organic S, %	0.080	2.430	0.818	0.434	142	0.450	0.920	0.559	0.146	12
HTA, %	2.030	38.109	13.501	7.138	146	4.750	26.261	16.196	6.887	12

*n = number of values available

Appendix B

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Region III - 6th & Walnut Sts.
Philadelphia, Pa. 19106

SUBJECT: Phone Conversation with Professor Alan Davis, Pennsylvania State University

DATE: SEP 24 1984

FROM: Dominic DiGiulio, McAdoo Project Coordinator
Site Response Section (3HW21)

TO: File

I spoke to Professor Alan Davis, Pennsylvania State University Coal Research Institute (814-865-3437) on Friday, September 7 to discuss the trace element content of anthracite coal near McAdoo, Pennsylvania. He provided the following information:

Element	Concentration
Beryllium (Be)	2.2 ppm - Average concentration in Anthracite Coal
	0.62 ppm - Average concentration in Buck Mountain Coal Seam
	7.8 ppm - Average concentration in Ash from Buck Mountain Coal Seam
Nickel (Ni)	127.0 ppm - maximum concentration in Anthracite Coal
	42.4 ppm - mean concentration in Anthracite Coal
Chromium (Cr)	75.6 ppm - maximum concentration in Anthracite Coal
	49.0 ppm - mean concentration in Anthracite Coal
Zinc (Zn)	66.0 ppm - maximum concentration in Anthracite Coal
	21.0 ppm - mean concentration in Anthracite Coal

He also stated that Beryllium is usually found in higher concentrations in coal than coal refuse.

Page retyped for NTIS-July 17, 1985

Appendix C

References

a. chronic value for Fathead minnow, method ELS, Halcombe et. al., 1980

b. chronic value for Daphnia magna, method LC, Mayer and Sanders, 1973

c. chronic value for Fathead minnow, method ELS, U.S. EPA, 1978

d. acute value for Bluegill (730 ppb), method S,U, Mayer and Sanders, 1973 divided by the acute chronic ratio for Daphnia magna for butyl benzl phthalate (42), Gledhill et. al., 1980

e. acute value for Daphnia magna (52,100 ppb), method S,U, U.S. EPA, 1978 divided by the acute chronic ratio for Daphnia magna for butyl benzl phthalate (42), Gledhill et. al., 1980

f. acute value for Daphnia magna (117,000 ppb), method S,U, U.S. EPA, 1978 divided by the acute chronic ratio for Sheepshead minnow (2.7-saltwater species), method ELS, U.S. EPA, 1978

g. acute value for Bluegill (3,980 ppb), method S,U, U.S. EPA, 1978 divided by the acute-chronic ratio for Mysid shrimp (2.5-saltwater species), U.S. EPA, 1978

h. chronic value for Fathead minnow, method EL, DeGraeve, et. al., 1980

i. Ambient Water Quality Criteria for hexachloroethane

j. criteria derived from the equation:
water criteria= [LD(50) of chemical) / BCF of chemical] x (47 kg-ug/ mg-1).
The correction factor (47 kg-ug / mg-1) was derived using the phenol criteria:
2560 ug/1 = [LD(50) of phenol (414 mg/kg) / BCF of phenol (7.6)] x (factor).
The BCF for phenol was calculated from the equation: log BCF= 0.76 log Kow-0.23.
Therefore the criteria for 4-methylphenol is calculated to be [LD(50) of 4-methylphenol (207 mg/kg) / calculated BCF for 4-methylphenol (18)] x 47 which equals 541 ug/1

k. criteria derived from logic used in (j.). The LD(50) and calculated BCF for benzl alcohol are 100mg/kg and 8.1 respectively

l. criteria derived from logic used in (j.). The LD(50) and measured BCF for dibenzofuran are 350 mg/kg and 1350 respectively

m. chronic value for Daphnia magna (beryllium sulfate), method LC, 220 mg/1 hardness as CaC03, Kimbal manuscript

n. Federal Register/ Vol. 49, No. 26/ Tuesday, Feb. 7, 1984

o. maximum concentration not to exceed $e^{[0.819 \ln(\text{hardness}) + 3.568]}$ obtained from (n.). Hardness equals 32 mg/1 as CaC03 obtained from 1SR5, the target location for metals

p. maximum concentration not to exceed $e^{[1.16\ \ln(\text{hardness}) - 3.841]}$ obtained from (n.)

q. maximum concentration not to exceed $e^{[1.34\ \ln(\text{hardness}) - 2.014]}$ obtained from (n.)

r. maximum concentration not to exceed $e^{[0.76\ \ln(\text{hardness}) + 4.02]}$ obtained from the Ambient Water Quality Criteria for nickel, October 1980

s. maximum concentration not to exceed $e^{[0.83\ \ln(\text{hardness}) + 1.95]}$ obtained from the Ambient Water Quality Criteria for zinc, October 1980

t. maximum concentration not to exceed 22 ppb obtained from (n.)

u. Ambient Water Quality Criteria for phthalate esters, October 1980

v. Ambient Water Quality Criteria for isophorone, October 1980

w. Ambient Water Quality Criteria for fluoranthene, October 1980

x. Ambient Water Quality Criteria for polyaromatic hydrocarbons, October 1980

y. Ambient Water Quality Criteria for hexachloroethane, October 1980

z. Ambient Water Quality Criteria for polychlorinated biphenyls, October 1980

1. Ambient Water Quality for beryllium October 1980

Appendix D

ATTACHMENT A

Commonwealth of Pennsylvania
Environmental Resources
January 2, 1985
787-7383

Subject: McAdoo Mining Activity Summary/Conclusions

To: Mike Steiner, Chief
Emergency and Remedial Response Section
Division of Operations

From: Eugene W. Pine, Hydrogeologist EWP
Emergency and Remedial Response Section
Division of Operations
Bureau of Solid Waste Management

Through: Solid Waste Program Specialist JAK

Recent investigations to determine the extent of underground mining activities at the McAdoo Associates-Kline Township Site have yielded certain data upon which the following discussion and conclusions are based.

Deep mining in the Silverbrook Basin, a structural as well as topographic synclinal basin of Pennsylvanian Age, began approximately 100 years ago. The prinicipal coal of economic interest was the Buck Mountain seam, originally deep mined by the Silverbrook Mining Company in the late 19th and early 20th Century. Later (1925), the Haddock Mining Company began a pillar removal operation which lasted until 1938, when all deep mining activities under the present site were terminated. The overlying Mammoth coal seam was originally deep mined late in the 19th Century, then later surface mined, so records for this particular seam cannot be considered very accurate. Two minor coal seams which exist between the Mammoth and Buck Mountain seams, the Wharton and Gamma seams, were not economically important and, consequently, were not mined in the area.

Groundwater conditions under the site are dictated by the mine pool network of the basin, which so often characterizes the anthracite area. Also, the underlying synclinal Pottsville formation forms a large "bowl" which essentially traps groundwater in the mine void network. Groundwater from the mine pools exits through the Silverbrook discharge, located approximately 1,500 feet south of the McAdoo site, into the Little Schuylkill River.

It is interesting to note that the Silverbrook Mine (as it is known today) was one of the few deep mines in the area in which water was actually pumped out of the mine, not "dewatered" by the drainage tunnels which are normally found in an anthracite operation in this area.

The present McAdoo Associates site area represents one of the earliest phases of the mining operation. It was within and adjacent to this area that the coal breaker/prep plant, associated shop and support buildings, and the Gordon slope--a main entrance to the mine--were located. Today, the foundations for some of these structures may still be observed on the site.

A review of the Silverbrook Mining maps from the 1920's and 1930's confirmed that the Buck Mountain seam was extensively deep mined along the length of the basin. In many areas, the Buck Mountain seam would split into a "main" seam and an overlying "rider" seam. Where the rider seam was sufficiently thick, both seams were mined separately on different levels. An exception to this would be where an insufficient thickness of shales and/or sandstone existed between the two seams. In this case, this rock was also removed with both coal seams and removed at the prep plant.

Records and mining maps indicate that in many areas of the mine, the support pillars were removed as mining activities in the area drew to a close. In some areas, the pillars were left in place, either for continued support or because the areas were considered "unmineable". While it is difficult to determine the extent of pillar removal, it is certain that the area was deep mined and a mine void network exists beneath the site.

I would conclude that, owing to the existence of an extensive mine void network, part of which underlies the McAdoo site (as documented by existing maps and some conversations with personnel with knowledge of the area), the potential for mine subsidence exists in the area. This potential must be considered prior to implementation of any remedial activities at the site. The effectiveness of specific remedial measures, such as installation of a cap over certain areas of the site, may be threatened by a future subsidence event, the magnitude of which is difficult to predict.

cc: Mr. Worley
Mr. Pine
Mr. Kozlosky
File
Chron.

EP:rd

APPENDIX E

RESPONSES TO ADDITIONAL COMMENTS FROM PRPS

Comments on the Hydro-Terra Mine Subsidence Study:

The study completed by Hydro-Terra for the PRPs was reviewed by EPA. The study was not considered accurate since two out of three assumptions upon which the report was based are in question. EPA has determined that this information in conjunction with information from the state will be reviewed during the design phase to determine the appropriate cap design.

Hydro-Terra states in Section 4.5 of its report that the analysis of the risk of magnitude of subsidence at the McAdoo site is based on three assumptions:

(1) That the location of the mine workings shown on the "original mine map" are accurate, as is the location of the workings in relation to the McAdoo site.

(2) The workings beneath the site have not totally collapsed or been backfilled.

(3) The pillars beneath the site have not been removed.

After reviewing parts of the McAdoo RI and a different but probably more recent mine map, it appears that assumptions (1) and (3) are in error. The RI states in section 2.4.2 that deep mining at the site commenced in 1884 with the opening of the Gordon Slope entry. Upper and lower Buck Mountain seams were reported to have been deep mined until 1910. Active mining started again between 1923 and 1926 and continued until 1938. During this latter period, it was reported that pillars were removed and the entire site area was completely mined. PADER provided EPA with a different map than that used by Hydro-Terra. The PADER map shows that most of the site had been deep mined and that extensive pillar robbing had occured in the western half of the site. It is believed that PADER's map is more current than Hydro-Terra's map because PADER's map shows more extensive deep mining and pillar robbing and because structures such as the breaker facility are located in different areas of the site. The PADER map shows a breaker located on the southern perimeter of the site, and a wash house in the west central portion of the site while the Hydro-Terra mine map shows the breaker located north of the site with no wash house. The RI states that at least three coal breakers were burned down or demolished and reerected at different locations. An aerial photo taken by EPA in 1969 shows a coal breaker south of the site with an old wash house onsite which ultimately became part of the incinerator structure. It is also interesting that at boring location B3 and B3A, the boring logs do not correspond to what is illustrated on Hydro-Terra's map. According to Hydro-Terra's map, there should not be voids at borings B3 and B3A yet the boring logs show a 3.6 foot gob filled mine void (upper Buck mountain coal seam) at a depth of 27.4 feet in boring 3 and a 10 foot void (Buck mountain seam) in boring B3A at a depth of 31 feet. According to Hydro-Terra, the Upper Buck Mountain coal seam was not even mined. Therefore, based on information presented here, it appears that assumptions (1) and (3) are not valid and thus the accuracy of the entire report is very questionable.

Hydro-Terra states repeatedly that there is a very low risk for mine subsidence whether it is sink hole or trough subsidence. In an interoffice memorandum, Gene Pine, a hydrogeologist from PADER stated that "owing to the existence of an extensive mine void network, part of which underlies the McAdoo site (as documented by existing maps and some conversations with personnel with knowledge of the area) the potential for mine subsidence exists in this area... the magnitude of which is difficult to predict." Potentially responsible parties have also questioned the risk of subsidence at the McAdoo site and requested documentation to show that subsidence has occured in the area. PADER has reported that actual subsidence has occured in the 54 square mile mining area in which McAdoo lies. More conclusive proof of past subsidence though is presently at the site itself. During test boring drilling, NUS noted that "all of the rock strata in the Llewellyn Formation was intensely fractured, probably as a result of subsidence caused by the mining operations." The test boring results not only provide evidence that past subsidence has already actually occurred but describe the overlying bedrock above mine voids which consists substantially of highly fractured weathered sandstone. During test pitting, 13 of the 36 test pits were excavated 0.5 to 4.2 feet into the bedrock. The bedrock was weathered and broken(more than normally expected). In evaluating the risk of subsidence, it would seem logical to consider the strength of overlying bedrock. Hydro-Terra did not comment on this point and therefore either did not consider it or believed it unnecessary in their evaluation.

In reference to trough subsidence, Hydro-Terra, states that "Instantaneous subsidence should have occurred long ago and that Time-dependent subsidence tends to be less than 10 percent of total subsidence... Most time-dependent subsidence should have occurred over the past 85 years, and future area subsidence should be less than six inches." Hydro-Terra also states that this type of subsidence could cause differential settlement over a horizontal distance of about 15 feet. In reference to sink hole subsidence, Hydro-Terra states that the probability "is very low because subsidence probably would have occurred during the past 85 years," Hydro-Terra does not estimate the possible surface vertical or differential settlement caused by sink hole subsidence except to say that sink hole collapse should propagate 60 to 150 feet above the mine workings. In reference to the vertical settlement caused by sink hole subsidence Hydro-Terra states earlier in the report that "the maximum amount of surface subsidence can be greater than the height of mine workings because debris can move into adjacent workings where collapse has not occurred especially if the workings are steeply inclined." Why wasn't the vertical and horizontal settlement estimated for sink hole subsidence? The Buck Mountain coal seam is steeply inclined at the site (45 degrees) and mine voids were found during test boring which may be susceptible to sink hole collapse. Test boring 3A had a 10 foot void at a depth of only 31 feet. Based on Hydro-Terra's previous statement concerning the vertical settlement mechanics of sink holes, it would seem possible that vertical subsidence greater than 10 feet is possible at TB 3A. Horizontal settlement at this test boring is probably in excess of the void area. If void areas extend 30 feet as suggested by records, then horizontal settlement could exceed 30 feet in width. An analysis has not been made concerning if soils could drop into the mine pool based on the subsidence potential. Expert assistance will be necessary to provide interpretation in this area.

Hydro-Terra bases much of their evaluation of the risk and magnitude of mine subsidence on the number of years since mining has begun. They repeatedly use 85 years as the time period over which mine subsidence should have already occurred. There is evidence at the site which does show that mine subsidence has occurred, but this does not mean that it will not continue to occur in the future since subsidence is a time-dependent deformation of ground surface and can always occur as long as mine voids exist. Eighty-five years seems to be an inappropriate time period to estimate the potential of mine subsidence since deep mining is reported to have ceased in 1938 and pillar robbing probably occurred during this latter date. Forty-seven years is a more appropriate time frame. Time dependent subsidence will continue to occur so void spaces become less and less. Future subsidence cannot be ruled out as long as void spaces still exist even if subsidence has not occurred for 50 or 100 years.

Some insight to the potential risk and magnitude of mine subsidence incidents is provided by Richard Gray of GAI consultants in an article published in the Northeastern Environmental Science in volume 2, number 2, 1983, titled "Alternative Measures in Undermined Areas."

> "...Subsidence is a time-dependent defamation of the ground surface resulting from readjustment of the overburden above a mine. Although the vertical components of movement are usually largest, horizontal movements and the resulting strains and deplacements are often most significant in causing surface damage. Some movements take place during mining and some after depending on the type and extent of mining, the thickness and character of the overburden and the mine floor and alter details on the site. The movements cover from a few square feet to many areas, and vertically from a few inches to several feet... In most cases the surface area affected by subsidence exceeds the area of the seam extracted... sink holes generally develop where the cover above a mine is less than 100 feet...[and] where rock cover is weak... troughs develop where a pillar or pillars fall by crushing or punching into the mine floor or roof... subsidence tends to reduce with increased internal above mine level. Sites located 60 or more feet above mine level avoided the majority of sinkholes. Sinkholes constituted 95% of all reported incident [however] a substantial thickness of overburden does not necessarily ensure safety from subsidence... Subsidence over abandoned mines may occur many years after mining...A study of the Prittsky coal seam showed subsidence has occurred as early as a decade after mining and as late as a century... more than half the subsidence incidents took place 50 or more years after mining....The time of occurrence of subsidence is undoubtedly governed by the rate of deterioration of the rock state and coal pillars, and by other factors which sometimes include mostly of pillars of small operators years after initial mining. This represents a complex interaction of phenomenon that prohibit convenient prediction of the time of subsidence... Sometime after mining complete collapse of abandoned entries and rooms is to be expected as a result of natural causes and activities of man... [subsidence will occur by increasing numbers of incidents for an extended period of time as progressive deterioration and failure of the rock surrounding the openings becomes more pronounced: And

> later a deminishing number of incidents as the void spaces at the mine level became fewer and fewer... This implies that the possibility of future subsidence at a site cannot be ruled out merely because subsidence has not been recognized in the first 50 or 100 years after mining. If abandoned mine openings beneath a site have not been designed for long term stability, the potential or subsidence remains until the openings collapse or until they are stabilized by backfilling, grout columns, or some other means... Even after subsidence has taken place at a particular site, the possibility of future subsidence may remain...

This article points out the difficulty in estimating the potential risk and magnitude of subsidence and the time span in which subsidence will occur. Based on these limitations and Hydro-Terra's previously stated assumptions (2 of which appear invalid) it does not seem that Hydro-Terra has substantial justification to state that the risk of subsidence at the site is very low, extremely low or improbable for different parts of the site.

Another point of contention is the numerical analysis presented in Section five. Hydro-Terra states that if sink hole subsidence were to occur, each case of subsidence should only affect less than 0.1 percent of the potentially contaminated soils at the site. This is an area which will require assistance from a mine subsidence expert for evaluation.

In the report, Hydro-Terra does make one very important point. That is "if subsidence were to occur, it is unlikely that contaminated soils from the site would become submerged in the mine pool." The model which was used to develop maximum safe contaminant levels in soils assumed saturated flow through the site fill if subsidence occurred to simulate a worst case scenario. During design of the cover, EPA will initiate a mine subsidence study of its own to attempt to evaluate the risk and magnitude of subsidence. If the study shows that the assumption of saturated flow conditions is erroneous, the soils model would need to be reevaluated.

The Approach to Capping the Site

Fred Hart Associates stated that "a need can only be established to place a soil layer with vegetative cover over the eight-acre site." Their statement is based on:

- The organic contaminants are stable and immobile.
- Inorganic contaminants are not present at higher than background levels.
- None of the contaminanats onsite violate RCRA EP Toxicity criteria.

As stated in the "Establishing Background Levels of Heavy Metals at the McAdoo Site" section, the levels of metals detected in soils onsite are above background. The site summary submitted to the PRPs described why high concentrations of organic contaminants are not stable at the site and why removal to predetermined soil criteria is necessary. The point that organic contaminants found at the site are immobile is frequently made by Hart Associates in the comments and forms part of the basis for the recommendation not to cover or remove soils at the site. Therefore, it is appropriate to discuss this point in greater detail.

The Remedial Investigation states that "significant soil contamination is limited to upper horizon shallow soils. Migration of pollutants to the deeper soils and ground water has not occured. DEHP (Bis 2-ethyl hexyl phthalate), the most critical soil contaminant was not detected in any onsite ground water." The RI states later on that since the contaminants are immobile, migration to the ground water will not occur.

Statements in the RI referring to the migration of organic contaminants are unjustified because of the lack of longitudinal sampling data, lack of consideration of the potential risk and magnitude of mine subsidence, and improper assumptions regarding transport mechanisms of organic contaminants. NUS did not consider the migration of inorganic contaminants because they believed them to be at background levels. EPA disagrees with this interpretation of the inorganic sampling data and thus considered migration of inorganics.

Only test pits 24, 3A, 33, and 25 have sufficient longitudinal sampling points. Sampling results seem to conflict with the RI's findings of significant soil contamination being limited to the upper soil horizon. In test pit 24, base/ neutral compounds were detected at 12 feet. In test pit 33, hexachloroethane was detected at 1.4 ppm at 10 feet. In test pit 25, base neutrals were detected at 5 and 7 feet. Other test pits especially those containing high levels of metals were not sampled at sufficient depths to determine migration. For example, test pit 14 contained high levels of beryllium, nickel, zinc, cadmium and lead but was only sampled once at a depth of 2.3 feet. Test pit 14 is located in an area where metallic sludges were believed to have been stored. DEHP was also found in test pit 14 at high levels. The highest level of DEHP found onsite was in test pit 9 at 960 ppm at 4 feet. Samples were only taken at 1.5 and 4 feet so the migration of DEHP into deeper soil

zones is unknown at this location. Therefore, as illustrated with these sample results, a conclusive determination cannot be made as to the past migration of contaminants in site fill.

It is also believed that assumptions in the RI/FS were inaccurate in regard to the transport of nonionic organics in both the unsaturated and saturated zones. The site fill presently exists under unsaturated conditions but could become at least partly saturated by an incidence of significant mine subsidence. Nonionic organic contaminants traveling in the dissolved phase absorb to organic carbon in soil or sediment with an affinity corresponding to their organic carbon partition coefficient (Koc). The more organic carbon in the soil and the higher the Koc value, the greater the ratio of an organic contaminants in soil to its concentration in the aqueous phase. If it is assumed that adsorption is completely reversible (researchers have shown that this is the case with many compounds) then it must be assumed that contaminant will eventually leach from site soils if the site is not hydraulically isolated. The question is not so much the ability of a compound to migrate, but the time or rate of migration and the eventual concentration in ground water. Since desorption depends on the washing out of soil by uncontaminated water, desorption rates will be greatest under saturated conditions and thus the resulting ground water concentration is highest under saturated conditions.

When attempting to establish safe soil levels for contaminants, desorption must be taken into account to predict the highest concentration in ground water resulting from contaminated soil. With the use of an appropriate ground water model or dilution factors, an estimation can be made to determine if contaminant levels in soil will affect public health or environmental targets. A model using dilution factors was applied at McAdoo to protect present and possible future aquatic life and humans who ingest aquatic life. The model assumes saturated fill conditions since there is an unknown possibility of mine subsidence. Mine subsidence could enable hydrophobic contaminations to reach the saturated zone in minutes in what could otherwise take hundreds of years.

As pointed out in the Hydro-Terra mine subsidence report though, the assumption of saturated flow conditions may not be valid. This comment will be reevaluated during design of the cover.

Even in the absence of mine subsidence though, contamination would eventually migrate to the mine pool in a slug like form and result in a similar type of release to the mine pool water except the release would occur over a longer period of time and maximum concentrations realized in the mine pool would probably be less than that which would occur under saturated conditions. Desorption can occur over a very long period of time and concentrations of contaminants could increase in deeper soil until eventual release is obtained. At this time maximum release will be obtained and greatest impact to aquatic life will occur.

If soils are removed according to criteria established by EPA, a RCRA cover would be acceptable for site closure. The cover must be designed and constructed to:

(1) Provide long-term minimization of migration of liquids.

(2) Function with minimum maintenance.

(3) Promote drainage and minimize erosion or abrasion of the cover.

(4) Accomodate settling and subsidence so that the cover's integrity is maintained.

(5) Have a permeability less than or equal to the permeability of residual soils at the site.

Therefore, if all soils containing levels of contaminants exceeding EPA criteria are removed, only a cover having permeability equal to or less than residual soils present at the site would be required.

The comment concerning contaminants not failing the EP toxicity criteria is not valid since soils are not routinely tested for EP toxicity during the RI/FS.

Dilution in the Mine Pool:

Fred Hart Associates believes that the 10X dilution factor used by EPA in the soil model is "far too conservative to appropriately reflect the situation at the site". Hart Associates estimated a dilution factor of approximately 400X based on:

- potential residual contamination covering site area of 8 acres
- potential net annual infiltration of 12 inches
- annual mine pool discharge of 824 million gallons based on October 1984's flow rate
- Correction factor of 1.2 to 1.5 to account for:
  - rainfall runoff
  - residual contamination covering only 4 acres instead of 8 acres
  - October discharge probably lower than the average daily discharge

The correction factor may not be appropriate because inorganic and organic levels in soils were found at greater than background levels in almost every test pit sampled during the RI. Data in the RI indicates that soil contamination on the site is extensive so the calculation should be based on 8 acres instead 4 acres. Also, the RI states that coal refuse is very permeable material so surface water will mostly percolate into the mine spoil rather than running off-site.

The other numbers appear reasonable and will be further evaluated during design to determine whether a dilution factor greater than 10 is valid. If any change in the dilution factor changes the affectiveness of the remedy selection, then a ROD amendment will be required.

The Pathways:

This section uses numerous excerpts from the RI and FS reports to substantiate the lack of pathways at the site. It is not necessary to comment on individual excerpts from the RI and FS made in this section since EPAs technical position regarding these points is outlined in detail in the site summary submitted to the PRPs.

Source of Contamination:

This section states that the remaining contamination presents an extremely low residual risk and uses numerous excerpts from the RI and FS reports reports to substantiate this statement. It is not necessary to comment on individual points made in this section because the site summary submitted to the PRPs summarizes EPA's technical position on every point. EPA re-evaluated the analysis of the data in the RI and FS in the ROD and justification is provided in the Summary of Alternatives section.

Receptors and Removal of Contaminated Soil:

Fred Hart Associates provides numerous excerpts from a 1973 A.W. Martin Associates report and various PaDER memorandams to describe the current water quality conditions in the Little Schuylkill River. EPA itself used the same sources when evaluating the river and thus accepted most of the conclusions presented. However, there is one conclusion which EPA does not agree with: that the Little Schuylkill River is so badly degraded that it is beyond recovery. Does this mean that the river will never recover? It is doubtful whether anyone could present data to substantiate this claim.

The NCP states that "Remedial actions are those responses to releases that are consistent with a permanent remedy to prevent or minimize the release of hazardous substances of pollutants or contaminants so that they do not migrate to cause substantial danger to present or future public health, welfare, or the environment."

A risk exists to future aquatic life and humans who ingest aquatic life. Most of the organic contaminants in site fill are hydrophobic and thus absorb strongly to organic carbon in soil or fill. Absorption is reversible through and thus even very hydrophobic organics may be eventually be released to the mine pool. The important question is not whether these organic contaminants will migrate, but when, and what will the maximum concentration in the mine pool be. Hydrophobic organics move much more slowly through soil than hydrophilic organics. A release could take hundreds of years. EPA assumed that recovery of the stream is possible within this time-frame, especially since the State intends to address the acid mine drainage point once the source of contamination at the McAdoo Site is remediated.

Another point which was ignored by Fred Hart Associates is that the river is presently being stocked with fish near Tamaqua, and stocking has been moderately successful. Many of the stocked fish are probably consumed by humans. These fish were not considered as receptors by Hart Associates.

Page retyped for NTIS-July 11, 1985

Bulk Disposal:

The NUS RI states that:

"Topographic conditions and subsurface features observed in TP-9, 10, and 24 (all in Zone 1) strongly suggest that bulk wastes were dumped onto the ground, in the the vicinty of the buried coal mine entry. Likewise, subsurface conditions observed in TP-25 (Zone 3) strongly suggest that liquid wastes were dumped onto the ground (or into the coal slurry pond)".

Since bulk liquids were handled on site, if the site operators wanted to dispose of bulk liquids, they would likely choose a very permeable location such as the Gordon slope entry. The fact that liquid wastes were disposed of directly or indirectly into the Gordon Slope is documented in the RI:

"with regard to the o-xylene and styrene found in the soils, the pattern and distribution of the o-xylene and styrene would indicate that the resin-like sheet covering the area is releasing these contaminants. It also confirms at the time of release, the contaminants moved over the soils and into the mine opening which acted as a sump. The combined factors; location of the storage tanks, presence of the resin-like sheet and its spill pattern, presence of the congealed resin in the ceiling of the slope entry ... and the chemical analytical data, are evidence that bulk liquid spillage took place in this particular area."

Further evidence of bulk disposal is documented in the test pit logs:

° Strong organic odors were detected while digging in many test pits

° Test pit of TP-3 had sharp organic chemical odors which caused skin, eye, and nasal irritation at 2 to 5 feet.

° Strong organic chemical and acid like odors are present in fill over the mine entry.

° TP - 25A contained strong organic chemical and acid odors which caused skin, eye, and nasal irritation. Red and green paint sludge was also present.

° TP - 26A contained an oily waste seep at 2'.

° TP - 33 had strong organic odors, and oily seepage water.

° TP - 35 had oily seepage water.

Since water or liquids on the site eventually percolate through the site fill and enter the mine pool, and since the mine pool water enters the Little Schuylkill River, it is reasonable to assume that bulk liquids in a diluted form could have reached the river and may still be present in the sediment.

Surface Run-off From the Resin Sheet:

Fred Hart Associates questions whether there is any direct evidence that the resin sheet is contributing to surface run-off. The RI states on page 5-9 that "the pattern of distribution of the o-xylene and styrene would indicate that the resin-like sheet covering the area is releasing these contaminants" o-xylene detected in soils underneath the resin sheet could release some contaminants via water solubilization or through sorption on micron size particles passing through course coal refuse. Since it is possible for o-xylene to migrate in soil, it is also possible for it to flow off-site via surface water run-off. The environmental impact of this run-off and concentrations of contaminants in off-site soils from run-off are unknown.

Fred Hart Associates also states that "given that the contaminants are stable, there is serious question as to whether removal would not in fact increase the environmental risks" but gives no explantion of how removal would present an environmental risk or whether the risk leaving the resin sheet on site out-weighs the risk of removal.

The Use of the MEGS Model at the McAdoo Site:

The Multimedia Environmental Goals (MEGS) Model was developed by EPA in 1977 to establish goals for compounds in air, water, and soil. There is currently no EPA policy regarding its use. The goals set by the model were not used for some of the same reasons the PRPs do not find them acceptable. The soil model assumes two liters of water can leach 100% of all contiminants from 1 kg of soil. As mentioned by Fred Hart Associates, this is an extreme assumption. Hart associates also mentions that the goals for metals in soil are so conservative that they are below background levels for many regions which is true. For these reasons, the MEGS model goals were not deemed appropriate for the McAdoo site.

Establishing Background Levels of Heavy Metals at the McAdoo Site:

Fred Hart Associates states that the Glick and Davis study is statistically flawed because of small sample size and large standard deviations for the metals of concern. They state that "natural levels of metals in anthracite coal may actually be higher than the study indicates... [and that] using metals concentrations of coal to determine background values provides only a crude estimate for soils on site ... [and] actual sampling of soils on site or adjacent to the site would be necessary to determine what background levels are for the McAdoo soils."

The summary statistics for whole anthracite coal from the Glick and Davis Penn state study are listed below. All values are given ppm.

metal	minimum value	maximum value	mean	Std Dev	n
Be	0.618	5.755	2.206	1.609	12
Cr	13.300	75.608	48.998	18.159	12
Ni	10.925	126.835	42.425	30.860	12
Zn	2.850	65.653	20.729	19.745	12

In the Buck Mountain Coal Seam, beryllium is found at a mean concentration of 0.62 ppm (Davis, September, 1984).

It is of course possible that in some locations natural levels of metals in anthracite coal may be higher than the maximum value indicated by Glick and Davis, but at the same time it is equally possible that in some locations natural metals values may be less than the minimum values reported by Glick and Davis. The variation in the range of values reported for these four metals is not significant when compared to the concentrations of metals detected at "hot spots" in site soil. For instance, the range for zinc is reported as 2.850 to 65.653 ppm in anthracite coal while 78,406 ppm of zinc was detected (dry weight) in test pit 25. The range for nickel is reported as 10.925 to 126.835 ppm while 2,012.4 ppm was detected in test pit 14.

Also, EPA does not believe that it is coincidence that the highest concentrations of metals detected in on site soils coincides with the areas where metallic sludges were reported to have stored and where bulk disposal of liquids took place.

EPA did take 3 off-site fill samples while test boring in areas which should not have been affected by the site. The results for metals of concern are illustrated as follows: All values are ppm.

Metal	B-8	B-9	B-10
Cr	4.9	3.3	5.2
Be	ND	0.3	ND
Ni	4.7	3.6	2.7
Zn	5.1	6.0	7.9
Cd	ND	ND	ND
Pb	8.8	1.1	7.4
Cyanide	ND	ND	ND

The concentrations of metals in the borings are obviously below levels expected from anthracite coal as is expected since coal typically contains higher levels of metals than coal refuse.

EPA did not select offsite boring sample results for background metals because the site overlies the Buck Mountain Coal seam which intersects the mine pool. Establishing background levels for metals below those normally found in anthracite coal could theoretically (and in this case unreasonably) involve significantly greater need for remedial action at the site.

For the reasons previously discussed and the fact that 12,560 drums of wastes, (many containing metallic sludges); 20 tons of lead silicate; and 60 tons of zinc waste were stored on site (it seems unrealistic to assume that none of these wastes were purposely or accidentially spilled onto the ground), it is obvious that metals are present in site soils at higher than background levels.

Biological treatment was removed from futher consideration because the long-term effectiveness of this method is unknown. Activated carbon treatment was removed from further consideration because the contaminants found on site are adsorbed to soil. Incineration and wet-air oxidation were removed from further consideration because they would have eliminated organics but concentrated metal concentrations. On-site disposal in a RCRA landfill was removed from further consideration because the RCRA cap would provide similiar protection since the ground water table does not normally come in contact with the soils. The only chance that contaminants would come in contact with the ground water would be through downward migration from precipitation. The location of the landfill would also be susceptible to subsidence and difficulty in monitoring and would cost twice as much as a RCRA cap.

After completion of the initial screening of technologies, as detailed evaluation of alternatives was conducted in order to identify those alternatives which may best address the problems on-site in addition to removing the remaining 15,000 gallon tank. The chosen alternative should be the most cost-effective, technically feasible, and reliable solution that effectively mitigates or minimizes damage to and provides adequate protection of public health, welfare, and the environment. Alternatives were developed by applying technologies considered individually or in combinations.

The alternatives remaining after the initial screening process were grouped into two catergories: site related and disposal related activities. The alternatives are listed below:

° Site Related:

- No remedial action
- Removal of debris
- Excavation and/or removal of wastes and most heavily contaminated soil
- Excavation of contaminated soil to background levels
- Capping which meets the standard of RCRA regulations 40 CFR Part 264 throughout the entire site
- Diversion of surface water

° Disposal-Related

- Off-site disposal in a RCRA permitted facility

These technologies were then combined in remedial alternatives that would be applicable to this site, and screened with respect to the remedial objectives. The following is a detailed analysis of these alternatives.